

AUGUST 1928—THIRTY-FOURTH YEAR

AUG 2 1928

# MACHINERY

THE INDUSTRIAL PRESS Publishers. 140-148 LAFAYETTE ST., NEW YORK

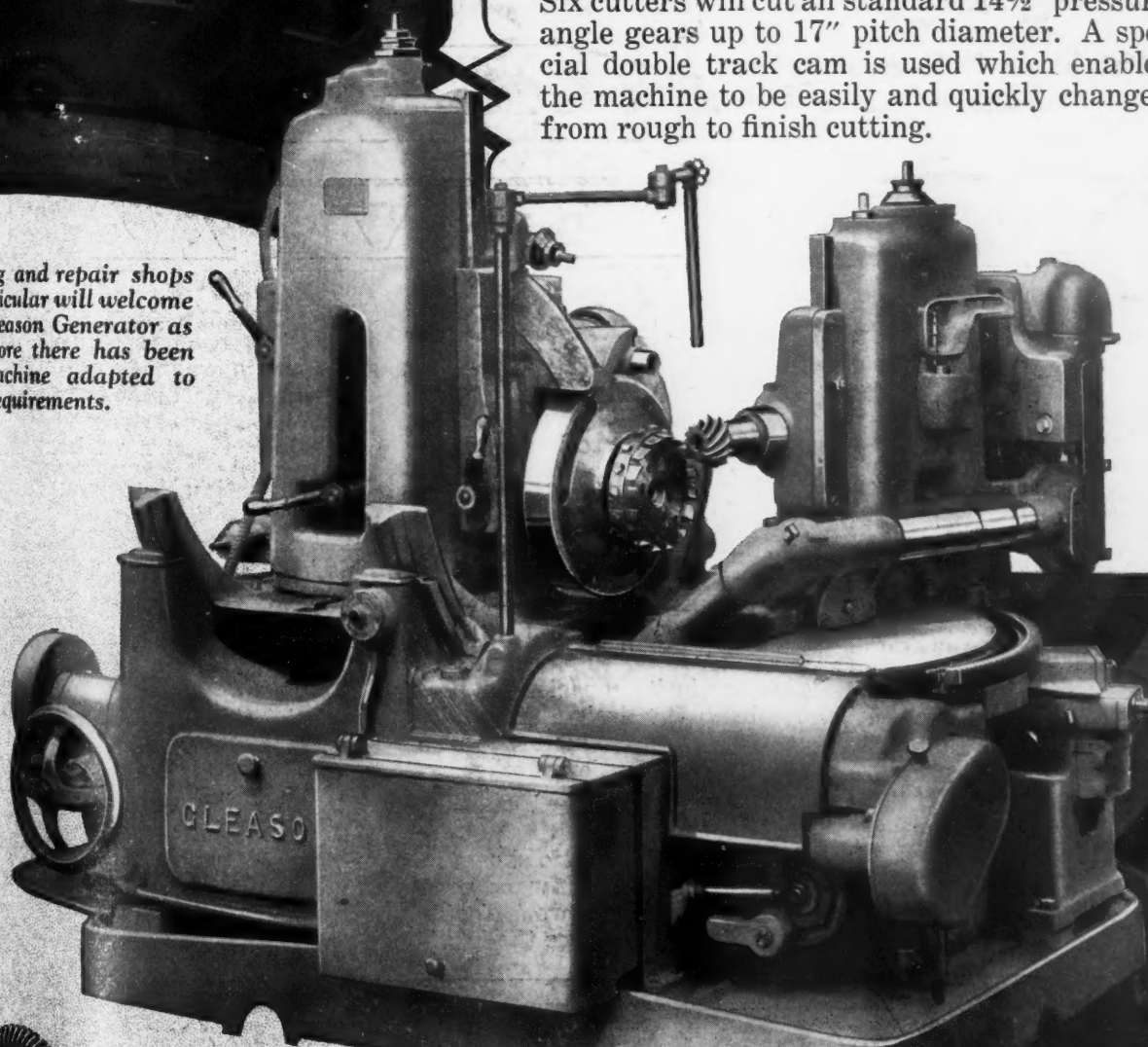
For Cutting Spiral Bevels in Small Quantities

## The GLEASON

### 15" Hypoid Pinion and Jobbing Spiral Bevel Gear Generator

This machine is for rough and finish cutting Spiral Bevel Gears in small quantities at reasonable cost. With the adjustments obtainable, a set of eighteen cutters will handle all standard jobs within the capacity of machine. Six cutters will cut all standard  $14\frac{1}{2}^\circ$  pressure angle gears up to 17" pitch diameter. A special double track cam is used which enables the machine to be easily and quickly changed from rough to finish cutting.

Jobbing and repair shops particular will welcome the Gleason Generator as heretofore there has been no machine adapted to their requirements.



## GLEASON WORKS

ROCHESTER  
N. Y. U. S. A.

Manufacturers of Gears and Bevel Gear Machinery for over 50 years



## For extra small call on

Hollow safety set screws measuring less than  $\frac{1}{4}$  inch in diameter are mighty valuable in the construction of light machines. There are seven of these extra-small sizes in the Bristo line.

Compared with slotted head and other types of set screws, Bristo hollow safety set screws are more effective—they set up tighter, hold their set even where there is vibration and can be quickly removed from a solid set-up.



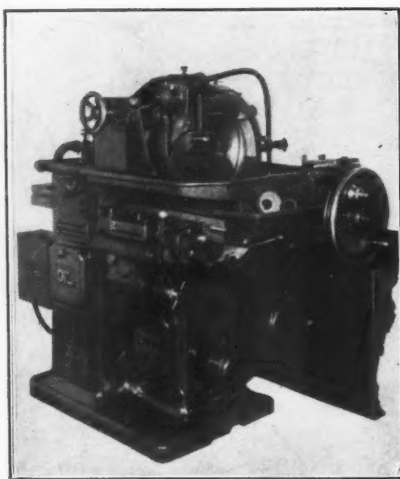
## set screws Bristo

Bristos, being hollow and manipulated by a wrench which fits the socket, can be handled with speed and certainty; no juggling and dropping Bristos.

These extra small sizes of Bristos, then, offer you dependability that aids in the best performance of your product, and speed in assembly that reduces costs. It will pay you to consider Bristos for your product.

*May we send you sample screws for inspection and test? Ask for Bulletin 819-E with complete information. Write The Bristol Co., Waterbury, Conn.*

**BRISTO *Safety* SET SCREWS**



Quarter-view of No. 12 Hydro-Matic. Note particularly the compactness of the machine, that all operating levers can be reached from one position, and that entire machine is operated with only one motor.

## Grinding Costs Cut by New Method

**Hydro-Matic Action gives  
Greater Production,  
Accuracy, Safety**

The new No. 12 *Hydro-Matic*, illustrated at the left, has made remarkable showings on various production jobs on which it has operated. Users express uniform pleasure in its capacity for production. Its design, naturally interesting to engineers, is also getting the attention of other executives because of the favorable records made.

Special interest is also shown in the big ball bearing work head which carries the work *inside* itself. This minimizes the inevi-

table play and, combined with other features, permits rapid grinding to very close limits. Tolerances of less than three ten-thousandths are easily maintained in production set-ups.

The most noticeable change from ordinary practice is to bring the wheel to the work *from the rear*. This has aroused enthusiasm on the part of operators because the wheel is protected all the time, and on the part of owners because it speeds loading and unloading. All danger to operators is done away with.

A new booklet is now being distributed. Copies can be procured by addressing the Company at Greenfield, Mass.

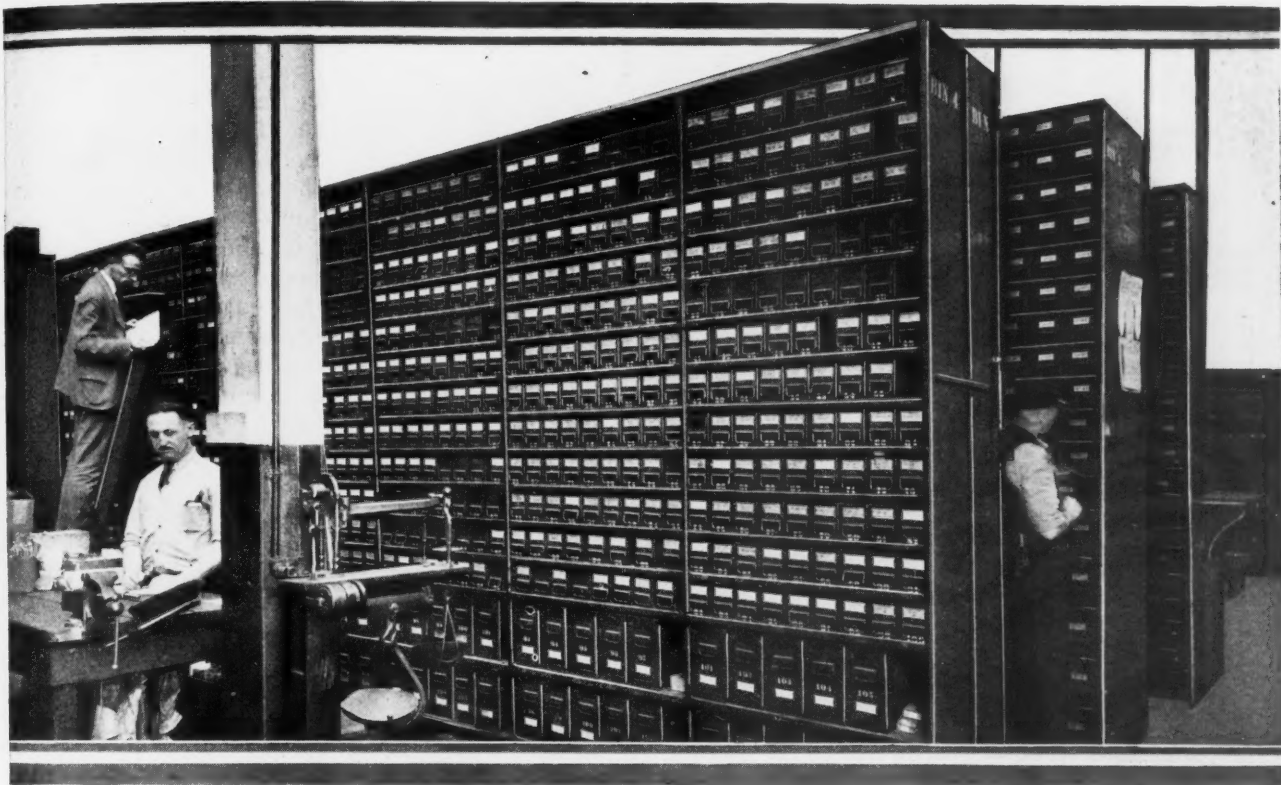


# MACHINERY

Volume 34

NEW YORK, AUGUST, 1928

Number 12



## Controlling Tools in an Automotive Shop

By CHARLES O. HERB

**S**YSTEMATIC supervision of tools, gages, micrometers and similar devices used in the operation of machines or in the inspection of work, is essential to the efficient operation of any shop. Without such supervision, these necessary accessories are likely to become lost, causing a heavy avoidable expense. Also, frequent tie-ups of machines or inspection operations may occur, due to inefficient methods of maintaining supplies for replacing the tools and gages, as they become broken or worn out.

Adequate tool supervision becomes increasingly important in the larger shops with their huge investments in tools. At the Detroit plant of the Continental Motors Corporation, which covers an area of seventy-five acres, tool-cribs are distributed throughout the shops; all of these cribs are responsible to one central stock-room. In this stock-room accurate records are kept of inventories and of all parts issued to the tool-cribs. The number of parts of any size or type

in stock can be immediately determined, at any time, by referring to a card. Various features of the tool system that is used in this plant will be explained in this article.

### How the Central Stock-room Functions

The supervision of tools comes under the direction of the non-productive division of the plant organization. This division is responsible for the maintenance of the plant and its equipment, and for the provision of new equipment as the old wears out. All cost items not chargeable directly to production are charged to the non-productive division.

In the central stock-room, from which tools and other supplies are issued to the tool-cribs, all small parts are stored in drawers arranged in tiers, as shown in the heading illustration. Larger and heavier parts are kept on shelves. The storing system is simple, since accessibility of supplies is fully as important as are records. All drawers and shelves are num-

MO FORM NPS 7 3M 5-23 M-H		CONTINENTAL MOTORS CORP		No 4201	
TOOL CHARGE SLIP					
NAME <i>William Kliner</i>		CLOCK 12-601			
HAS NOT RETURNED THE FOLLOWING ARTICLES TO TOOL CRIB FOR CLEARANCE					
1	12-inch Micrometer				
2	1/4-inch Drills				
1	Height Gage				
DATE <i>1/26/28</i>		<i>Fidman</i> TOTAL TOOLKEEPER			

Fig. 1. Slip Used by the Tool-crib Attendant for Notifying Operators and Inspectors to Return Borrowed Supplies



CARD NO. 4C2		LOCATION 1-J10		NAME Norton Alundum Grinding Wheel		SIZE 1/4 x 3/4 x 3/8																																																																																																																																																																																																																																											
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Fig. 2. Live Record Maintained in the Central Stock-room of Every Tool, Gage, or Other Machine or Inspection Accessory

bered, and careful records are kept of the drawers or shelves to which the thousands of different tools and other supplies are assigned.

For every tool and other accessory used in the shop, there is maintained in the central stock-room a record such as shown in Fig. 2. At the top of this card a record is kept of orders issued for the part; the date ordered; the quantity desired; the date on which the parts are received; and the number of parts received. At the bottom of the card and on the reverse side, a record is maintained of the parts issued to the tool-cribs and of the parts received from them. Under "Balance" is entered the number of parts in stock at any time.

In the middle of the card, spaces are allowed for recording the number of parts withdrawn from stock during each month. There is also room for marking the cost of the parts supplied on each order. At the upper left-hand corner is a "Minimum" space in which is marked the lowest number which the supplies in stock are permitted to reach be-

fore an order be made out for replenishing the stock. The record shown in Fig. 2 is used only for supplies purchased from outside sources. Records of special parts made in the tool-room of the plant are maintained on cards such as illustrated in Fig. 3. This record shows the dates on which requisitions were made for tools; the dates on which the orders were actually made out; and the dates on which the desired parts reached the central stock-room. At the bottom of the card and on the reverse side records are maintained of the number of parts issued to the tool-cribs and of the balance on hand.

When supplies are requisitioned by the central stock-room to meet the demands of the shop, the form illustrated in Fig. 4 is used to instruct the purchasing department to buy supplies from sources outside of the plant. This requisition slip must be signed by the supervisor of factory tools and supplies and must also be approved by the factory

#### Issuing Tools From the Crib

When a machine operator or an inspector first

SPECIAL TOOL RECORD—CONTINENTAL DESIGN																			
Tool No.		For Part No.				Oper. No.		Tool Name				For Dept. No.							
13671		B2L-103						Replacement Plug 0.504" No. 90				54 10 15							
Detail No.		6YH-101						Part Name				Minimum							
3		8FH-224						Oil Pump Drive Gear											
		8FH-225						Operation Name											
REQUISITION								ORDER				RECEIPTS				RECEIPTS			
Date	Amt.	Req. On	For	Date	Amt.	Ord. No.	Ord. On	Date	Amt.	Ord. No.	Due	Date	Amt.	Ord. No.	Due				
5/19/26	4	T.R.	54-10	5-20	4	25362	T.R.	7-22	4	25362									
7/2/27	4	T.R.	-	5-18	4	64854	T.R.	6-14	4	64854									
11/1/27	4	T.R.	54-10-15	11-2	4	69216	T.R.	11-27	4	69216									
7/2/28	4	T.R.	-	3-1	4	78131	T.R.	4-12	4	78131									
DISBURSEMENTS AND SUPPLY ON HAND																			
Date	Dept.	Rcd.	Out.	Bal.	Date	Dept.	Rcd.	Out.	Bal.	Date	Dept.	Rcd.	Out.	Bal.					
7-22-26	T.R.	4		4	10-31-27	T.R.		2	0										
4-14-27	C-7		3	1	11-27-27	T.R.	4		4										
5-23-27	C-7		1	0	2-24-28	C-7		3	1										
6-14-27	T.R.	4		4	4-12-28	T.R.	4		5										
7-7-27	C-7		2	2															

Fig. 3. Card on Which a Record is Maintained of All Special Tools made by the Plant Tool-room

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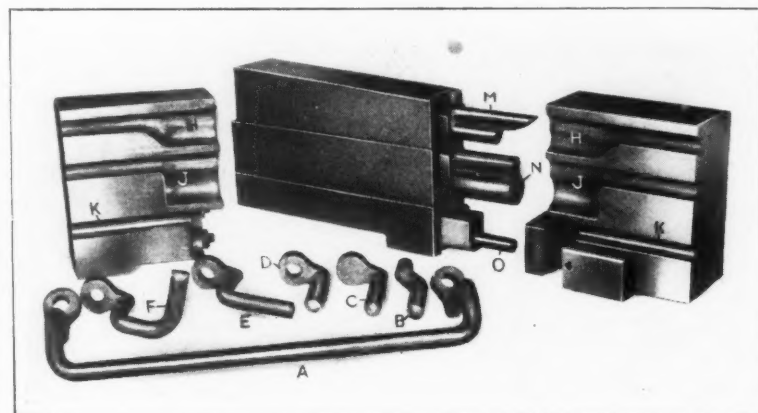


## FORGING RAILWAY-CAR GRAB-IRONS

Three forging and two bending operations are performed on each end of railway-car grab-irons of the type shown at A in the accompanying illustration. This illustration also shows the gripping dies and tools for the forging operations, which were designed by the Acme Machinery Co., Cleveland, Ohio, for use in one of the machines built by this concern. The stationary gripping die is shown at the extreme right and the movable gripping die at the extreme left. For performing the operations, one end only of the stock is heated to the forging temperature, and the various forging and bending operations are then performed successively on this end. After the work has cooled, the second end is heated, forged, and bent in the same manner as the first.

For the first operation on either end, the stock is extended into the upper impression H of the stationary die until it comes in contact with a stop. Then as the ram of the machine advances, the movable die clamps against the stationary die and plunger M enters impressions H to forge the work as shown at B. The stock is then quickly placed in impression J of the stationary die, and as plunger N enters the closed dies, the work is formed as shown at C. Finally, the stock is placed in impression K of the stationary die, and as plunger O enters the closed dies, the stock is punched as illustrated at D.

While still hot, the forging undergoes two operations in a bending attachment on the same machine to bring it successively to the shapes illustrated at E and F. Obviously, when similar forging and bending operations have been performed on the opposite end of the stock, the work has the appearance shown at A. Die-blocks for such operations are generally made from chrome-nickel steel, and the tools or plungers from tool steel. In producing grab-irons from 3/4-inch diameter stock, the production averages seventy-five to ninety complete parts per hour.



Die Equipment Employed in Forging Grab-irons Such as Shown at A

\* \* \*

The length of run of locomotives has been greatly increased during recent years. The maximum run for a freight locomotive is now about 350 miles on some railroads, compared with less than 100 miles a day about six years ago. The average run for a passenger locomotive today is 154 miles, while only a few years ago the average run was only from 110 to 115 miles. A sub-committee on the utilization of locomotives of the Mechanical Division of the American Railway Association reported at its recent meeting that in some unusual cases, passenger locomotives make continuous runs of from 800 to 900 miles. Such runs were unheard of even a few years ago, and are not very common now.

## FUTURE AUTOMOBILE DEVELOPMENTS

At a recent meeting of the Dayton Section of the Society of Automotive Engineers, T. J. Litle, past president of the society, outlined his ideas of the future development of passenger automobiles. He stated as his belief that, in the competition for supremacy in the next few years, many epoch-making inventions will be made; that virtually all automobile engines of the future will have superchargers built directly into them; that the engines will be smaller, but will give a greatly increased power output; and that the four-cylinder engine will pass out of the picture and be superseded by the eight-in-line engine operated at higher speed than the six-cylinder engine. Revival of the two-cycle engine, particularly in connection with the supercharger, was predicted. There are also indications of a coming revival of interest in the air-cooled engine.

Although large cars always will be produced in a limited way, there will undoubtedly be development toward the small and medium-size light-weight car luxuriously equipped and having easy-riding qualities. Complete non-ferrous bodies will, he believes, be in general use in a few years, as weight and noise must be reduced. Aluminum, wood, fabric, and certain composite materials are more suited for body construction than steel.

Power brakes, Mr. Litle thinks, will eventually be used on all but the cheapest cars, and many radical improvements will be made in accessories. Also, chromium-plating will universally replace nickel-plating on all exposed surfaces and will be used on bearing surfaces.

The pace for striking innovation will be set by small new companies, in the opinion of Mr. Litle, who predicted the formation of many such organizations, saying that the large corporations are sensibly conservative.

\* \* \*

## BRITISH COMMERCIAL AVIATION

Commercial aviation in Great Britain has been aided by subsidies by the British Government during the last seven years to a total amount of \$7,000,000, and at present, the Imperial Airways, Ltd., receives a subsidy of over \$800,000 a year. In Germany, air transportation subsidies voted by the federal government and municipalities amount to \$6,500,000 annually, and France supports commercial aviation with \$3,170,000 a year. The Imperial Airways, Ltd., has made a remarkable record for safety. During the entire period 1919 to 1926, only fifteen passengers were killed in regular service out of 85,900 passengers carried. During the last two years there have been no accidents whatever resulting in death or injury.

# What You Should Know about Patents

By H. L. KAUFFMAN, Consulting Engineer, Denver, Colo.

THE subject matter of patents must be of such character as to have called for an exercise of the inventive or creative faculties of the mind, as distinguished from mere exercise of the knowledge and judgment expected of those skilled in the particular art to which the patent pertains. This point has been repeatedly referred to in articles on the subject of patents which appeared in June and July MACHINERY. However, mention should be made of the fact that the right to a patent does not depend upon the amount of thought, ingenuity, skill, labor, or experiment that was bestowed upon the production. This article will discuss various phases of patent regulation as concerns invention, forfeiture regardless of intent, abandonment of invention, and related matters.

## The Act of Invention is Primarily Mental

It is generally understood that the act of inventing is primarily mental and involves the conception or mental construction of a means not previously known for accomplishing a useful result. Invention does not lie in the mere adaptation of old means by common reasoning, but is the construction of new means through an exercise of the creative faculties of the mind. In patent law, the terms "invention" and "discovery" are synonymous, and while the discovery of a new substance, element of nature, principle, or force, is not patentable, nevertheless it may be possible to patent the invention or discovery of a new means for making those matters practically useful.

Mere novelty and utility are not enough to sustain invention, for an inventor of a true "invention" must do something that the ordinary person skilled in the art would not know how to do if the occasion arose. Doing something that no one else has done before does not necessarily constitute an invention; nor does invention reside of necessity in doing a thing better or in the fact that the claimant was the first to see the occasion or to appreciate the advisability of doing the thing. An article is not patentable merely because it is better, cheaper, or more merchantable than any previous articles of similar nature. However, novelty combined with superiority may show invention.

Simplicity of the means employed does not show that there was no exercise of the inventive faculty in devising those means. On the contrary, the highest order of inventive genius may have been re-

quired to perceive that such simple means might be used to accomplish the desired result. So, too, complexity is no proof of invention, and the elements in the means employed may be multiplied indefinitely without constituting invention.

Mere mechanical skill, and not invention, is said to reside in a thing done by an ordinary person skilled in the particular art, who, when advised of the end to be accomplished, spontaneously thinks of or produces the means for the accomplishment of that certain thing. Means for making an article more perfect in form or giving to it a superior finish are not patentable. To be patentable, an article must be new in itself and not merely in work-

manship; hence, a machine-made article is not patentable over one that has been hand-made. Likewise, any change in an existing means that produces nothing except a difference in degree of that means is not patentable.

Although mere duplication of parts is not patentable, it sometimes happens that one so modifies the other as to produce a new result (not the mere added results of the two) and, consequently, there may be patentability. Use of an old means for a new, but analogous purpose, is not patentable. However, the transfer of an old invention from one art to another to which it is not analogous, and the adaptation of it to perform new functions and to accomplish new results in the new art, may amount to invention. If the new use be

so clearly analogous to the former one that the applicability of the device to its new use would occur to a person of ordinary mechanical skill, it is only a matter of so-called "double use," and is non-patentable; but, if the two are remotely related, and especially if the use of the old device produces a new result, there may at least be involved an exercise of the inventive faculty, which constitutes invention.

## Substitution of Equivalents Not Necessarily Invention

The substitution of an art, machine, manufacture, or composition of one element or device for another that performs the same functions in substantially the same way and accomplishes substantially the same result is not invention. In patent law, the substantial equivalent of a thing is considered as being the same as the thing itself. Consequently, although two devices may differ in name and form, if they perform the same function in substantially the same way and accomplish sub-



stantially the same result, they are considered as being the same. The mere fact that the substituted part performs the function better does not make an invention out of the act of substitution, unless some new or added function or result that would not be obvious to one skilled in the art is obtained.

Mere substitution in an old article of one material for another, wherein the material performs substantially the same functions, is not an invention even though the substituted material may be better for the purpose. However, if the substituted material performs new functions and its adaptability for the purpose was not obvious, there may be invention in the substitution. In this connection, it might be mentioned that substitution may be considered on the issue of invention where such substitution makes possible changes in other elements of a combination to produce improved operation.

Ordinarily, a change in the relative location of parts is not an invention unless the functions performed are also changed; and, while the omission of a part (with a corresponding omission of its function) is not an invention, invention may exist in the omission of a part with a rearrangement of the remaining parts whereby the same result will be secured by the use of a lesser number of parts. Generally, there is no invention in making solid castings in place of attached parts or in making separately parts that previously were made integral, since these practices are so well known as to be within the knowledge of the ordinary mechanic. Likewise, there is no invention in merely making an old device in such form as to be portable.

#### Rulings Concerning Combinations and Aggregations in Inventions

Inventions are patentable when old elements are brought into new relations, wherein, by their interaction, they perform new functions and produce a new result. But, merely to extend the use of an old combination of elements, wherein neither a new result nor a new method of producing the old results is produced, does not constitute invention. It is immaterial whether or not there is novelty or lack of novelty in the separate elements of an invention, since invention resides in the particular manner in which those elements have been combined. When an inventor claims a combination to exist, there is usually an implied concession that the elements, considered separately, are necessary for each element to perform its own function and also to modify the function performed by every other; however, there must be such co-action and modification that a result is produced which is not merely the sum of the results produced by the separate elements.

"Aggregation" may be defined in patent law as being the mere bringing together of separate elements without changing the function performed by

them or without producing any result other than the added result of the separate operation of the elements, such a combination being non-patentable. To be patentable a combination must produce a different force, effect, or result in the combined forces or processes from that given by their separate parts. No one, merely by bringing together several old devices without producing a new and useful result (which result is the joint product of the elements of the combination and is something more than an aggregate of old results), can acquire a right to prevent others from using the same devices either singly or in other combinations. Or, even if a new and useful result has been obtained, no person can be prevented from using some of the devices, omitting others, in combination. Under no considerations does mere superiority of an aggregate make that aggregate patentable.

As mentioned in one of the previous articles, multiplication alone of elements does not produce a patentable invention; no exercise of the inventive

faculty is involved merely in collecting at one place or in one machine a number of elements which do not so modify the actions of each other as to produce a new result. It might also be mentioned that novelty in one or more of the separate elements does not justify a claim to the collection of those elements unless there is co-action between them producing a new result, in which case, if claimed separately, the novel element may be patentable.

#### Evidence of Invention

Evidence of the inventive ability of a person, as distinguished from mere judgment and skill,

in conceiving and producing a certain device or process, is usually shown definitely by submitting proof that others skilled in the art had previously sought to accomplish the results of the patented device and that their efforts and experiments were unsuccessful. Further evidence of the exercise of the inventive faculties of a person is shown by proving that the patented device filled a long-felt want and that there had been no previous means for accomplishing the results of that device. The fact that the patented device meets with immediate public favor and displaces others on the market for the same purpose is evidence of utility and some evidence of invention. However, owing to the fact that the popularity of the device may result from extensive advertising or from other things than superiority, such evidence will not be accepted as proof except in cases of doubt.

#### How Patent Forfeiture May Occur

Since the purpose of the patent system is to secure for the people of the United States a knowledge of and the right to use (after the patent has expired) new inventions and discoveries, the inventor is required to proceed diligently in securing his patent under penalty of a forfeiture of his elementary right. As a matter of fact, there are

provisions in the statutes by which this forfeiture may occur contrary to the inventor's intent and without his knowledge.

If the invention for which application is being made has been described in a patent or printed publication in this country or abroad, with or without the knowledge or consent of the inventor, more than two years before his application for a patent was filed, no valid patent can be issued. If an inventor or his representative secures a patent in a foreign country upon the invention more than twelve months before his application in this country, no valid patent can be issued in the United States. If an inventor conceals his invention from the public for a long period of time after the invention has been perfected and if, in the meantime, someone else makes the same invention, then that invention either becomes public property and cannot be patented by any one, or else it can be patented by the one who was really second to invent, but the first to give the invention to the public.

When an application for a United States patent has been forfeited and then renewed, or has been filed as a substitute for and a continuation of a prior application, the original filing date on the application is the date that controls. However, in order to obtain the benefit of this original filing date, the renewal must be made in accordance with the terms of the law; if there is unreasonable delay between applications, then the date of the second application is the controlling date. These same general principles are applicable to divisional applications. These are important facts for inventors to keep in mind.

#### Prior Public Use of a Patent

It is considered that use of an invention by the inventor himself or by others at any time within two years prior to the date of application for the patent, may constitute "prior public use." However, whether used by the inventor himself or by others, the use must be such as would make the invention accessible to some members of the public. This does not mean a general adoption or use by the public; but, instead, a use in public as distinguished from a secret use. Exhibition of a design is considered public use. General or continuous use of a device is not necessary, since one instance of public use by a single individual will act as a bar to the grant of a patent. This bar may arise, regardless of whether or not the inventor either has knowledge of or consents to the use of that device.

To constitute public use, the invention must have been complete. This does not mean, however, that the machine embodying it must have been perfect, but merely that it was sufficiently perfect to be practically applied to its intended use. Experimental use of a device having in view the perfection of the invention is not considered public use, even though such experiments are carried out in public. Dependent upon the character of the particular in-

vention and the time necessary to develop and perfect it and to determine its practical efficiency, such experimental use may continue for years without operating as a bar to the allowance of the patent.

Use of the invention in secret, either by the inventor himself or by his representatives under an injunction of secrecy, is not public use. However, permitting another to use the invention without an injunction of secrecy is public use, even though the use may have been concealed from others. Use of an invention in public in its natural and intended way constitutes public use, although the invention may be concealed from the general view of the public.

When an invention has been used for the purpose of experiment, the mere fact that a profit may have been derived from the use of the invention does not constitute public use. However, if the desire for profit was the controlling cause of the use of the invention and the matter of experiment was merely incidental, then the grant of a patent covering that invention is barred. Use of an invention in a foreign country is not construed as being a public use that will tend to invalidate a patent in the United States.

#### When is an Invention "On Sale"?

An invention is said to be "on sale" when articles or machines embodying it are made and offered for sale or are sold, a single, unrestricted sale being sufficient. However, an offer or agreement to make and deliver an invention not already made and tested does not place that invention on sale, and neither is the assignment of the right to

secure a patent so considered. It should also be noted that an offer to sell articles previously made and tested, in which is embodied the invention, places that invention on sale even though no actual sales were made.

A sale made for the purpose of securing an adequate test of the invention does not place the invention "on sale" within the meaning of the law. On the other hand, the patent law clearly differentiates between sales made for the purpose of testing the market and sales made to test the invention itself, it being considered that the former is a trader's and not an inventor's experiment, and does not warrant any exceptions in the interpretation of the statutes. "Conditional" sales do not bar the allowance of a patent, for, to constitute a bar, the sale must be absolute. When the inventor retains a certain control over the machine for purposes of test, then the invention has not been placed "on sale" within the meaning of the law. It is not necessary that the machine sold shall be perfect or be well made mechanically, but it is sufficient that it be operative. In establishing whether or not a machine had previously been on sale, the presumption is against two years public use or sale, and the burden of proof is upon the one alleging it to establish that fact beyond a reasonable doubt. How-



ever, when the prior use or sale of the machine has been established, then the burden of proof rests upon the patentee to show that the sale was made for purposes of experiment.

#### Abandonment of Invention

The abandonment of an invention is the relinquishment by the inventor of his elementary right to secure a patent upon an invention made by him and the consequent dedication of that invention to the free and unlimited use of the public. An invention may be abandoned at any time either before or after application has been made for a patent; further, the right once abandoned cannot be resumed. Abandonment of an invention is not confined to the subject matter of reissued patents, for the statute applies to all patents. While abandonment involves a consideration of the inventor's intent, that intent may be presumed from the conduct as well as from the words of the inventor. Declaration by the inventor to the effect that he does not intend to secure a patent upon his invention amounts to abandonment.

The conduct of an inventor may be such that he indicates his intention to abandon an experiment; for, when an inventor acquiesces in the use of his invention by others and his conduct is such as to lead the public to believe that he does not intend to secure a patent, then it can be considered that the inventor has abandoned his invention. Hence, the acceptance of a patent with claims narrowed to exclude matter cited by the patent office as an anticipation is an abandonment thereof to the public. Further, one who retires from an interference proceeding and withdraws his claim for the specific element forming the subject of the interference is thereafter precluded from claiming such element under his patent. Publication is not abandonment, and merely permitting others to use an invention prior to application for a patent does not amount to abandonment; likewise, mere delay in applying for a patent is not abandonment.

Unless the complete invention has been disclosed to the public, there can be no instance of abandonment; so, too, abandonment of experiments upon an incomplete and imperfect invention is not a dedication of that invention to the public. What is disclosed in a patent and not claimed therein either is presumed not novel or is dedicated to the public by the patentee. However, this presumption is rebutted either if the patentee has another application pending in the patent office claiming that particular invention or if he files an application for it promptly. Matter erased from one application and presented in a second, after the grant of a patent, cannot be considered as an abandonment of that matter.

One may abandon a particular application for a patent without abandoning the intent to secure a patent at some time, and therefore without abandoning the invention claimed therein; for the inventor may file a subsequent application and secure a patent. Nevertheless, where an application for a patent has been filed and withdrawn, lapse of time is a fact that may give great point and force to testimony disclosing what was done in the interval.

Concerning the question of "evidence of abandonment," it can be said that abandonment is never

presumed. On the contrary, the presumption is against abandonment, and the burden of proof rests upon the one asserting it to prove abandonment of the invention beyond reasonable doubt. This attitude is taken because of the fact that issuance of letters patent is *prima facie* evidence that there has been no abandonment. When evidence has been submitted to raise a presumption of abandonment, it may be rebutted by showing acts prosecuting or asserting the discovery, as, for example, the filing of drawings in the Patent Office. When undisputed acts of an inventor furnish evidence of abandonment, the inventor's testimony that he did not intend to abandon his invention is not entitled to much weight.

#### Summary of Patentability

In summing up the matter of patentability, it should be said, first of all, that to constitute an invention the device or process should be novel. If the particular invention was never known or used by others in this country, or disclosed in any printed publication or patented before the date on which the invention was made, then the invention is new. The effective date of a United States patent, for purposes of anticipation, is the filing date of the application. If the anticipating publication or patent or public use carries a date more than two years prior to the filing date, no patent can be granted. "Usefulness" or "utility," as interpreted in patent law, means that the invention is not frivolous or contrary to good morals and, also, that it is capable of operating in the manner described. The usefulness or utility of an invention has nothing to do with its efficiency.

An "assignment" is a conveyance or sale of the entire interest in a patent to another. By making an assignment or conveyance, the inventor divests himself of all interest in the patent. A "license," however, is a contract by which the owner of the patent agrees not to molest the licensee if he uses the invention, and the patentee has a right to exclude others from the use of the invention. When a patentee gives a license to another, he merely agrees not to exercise his right to exclude the licensee.

It is a definitely established fact that an inventor has no special right to his invention beyond the protection given by the patent laws. If an inventor keeps his invention secret and this secret is betrayed, then the inventor may have grounds for an action if he can prove the existence of some contract between himself and the betrayer by which secrecy was imposed on the latter. Patent protection to an inventor begins only on the date of issuance of the patent by the Government of the United States.

\* \* \*

One of the efforts made by the railroads to economize in operating expenses has resulted in a saving of fuel equivalent to \$360,000,000 since 1920. These savings are due to the successful efforts that have been made to increase train loads and speed up the movements of trains, and also to the efforts of the International Railway Fuel Association in devoting itself extensively to the subject of fuel economy.

## Conveyors that Cut Handling Costs



**A**N interesting example of the possibilities of reducing time, labor, and costs in handling a product by means of a conveying system is described in the present article. The accompanying illustrations show a continuous production conveying system installed at the plant of the Maytag

The aluminum tubs of the Maytag washer are fed upside down to the main assembly lines, by a gravity roll spiral, from the floor above, the upper end of the conveyor being shown in Fig. 1. The gyratory drive is assembled by several operators, who take the main portion of this unit from the overhead carrousel conveyor, add their part or parts, and return the assembly to the conveyor. The assembled gyrator drives are next attached to the tubs. The tubs then proceed along the gravity roll to the next operation—that of mounting the plain legs and motor platform or leg brace (see Fig. 2). The preliminary assembly of plain legs is done by the operators seen in the foreground of this illustration. They hang them on the carrousel conveyors which carry them to the final assemblers.

Meanwhile, preliminary assembly of the power leg of the washer has been accomplished as shown in Fig. 3. A carrousel conveyor carries the parts in specially designed pans through the various operations to the test benches in the foreground.

After being tested, the power legs are returned to the conveyor shown to the right of this illustration, for delivery to the assemblers, as shown in the foreground and to the right in Fig. 4.

When the tubs reach this point they are removed

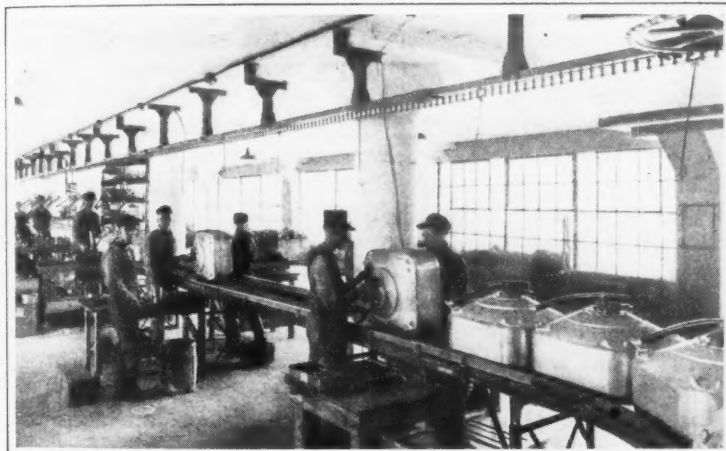


Fig. 1. Upper End of a Gravity Roll Spiral which Carries Washing Machine Tubs from an Upper Floor to the Assembly Floor Below

Co., of Newton, Iowa. Before this conveying system, which is of the Rex type, built by the Chain Belt Co., Milwaukee, Wis., was installed, the production was 800 washing machines per day. With the new conveying system, the production has reached 1250 machines per day, and fewer men are required in the assembly operations.

Starting from the foundry, the rough aluminum castings are trucked to the aluminum grinding room for the first operation. Here they are hung on carrousel conveyors, as shown in the heading illustration, by means of which they are distributed to the grinders and collected from them for each succeeding operation, including inspection. Each operator takes off the parts as he needs them, and then returns them to the conveyor line when the operation is completed. These conveyors are approximately 175 feet long, and operate at a speed of from 15 to 16 feet per minute. Another conveyor of the same type performs the same function in the machine shop.

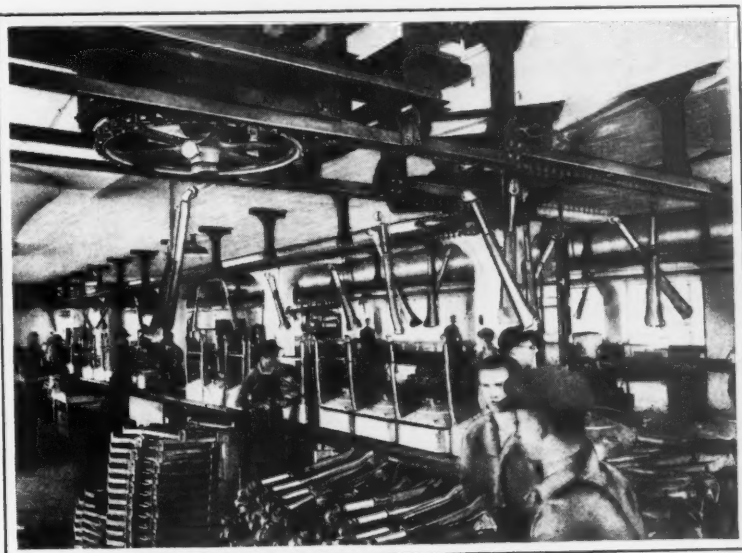


Fig. 2. Gravity Roll Conveyor and Overhead Carrousel Conveyor Used in Assembling Operations





Fig. 3. Conveyor Carrying Parts in Specially Designed Pans to the Assemblers

from the gravity rolls, and the power leg is added. After this is done, the machines are placed on the pusher type floor conveyor shown at the left of Fig. 4 and in Fig. 5, for the final testing and adjustment operations. As the machines move down this conveyor, the wringers are assembled on a parallel carrousel conveyor, seen in the background of Fig. 5. The wringers are attached to the machines after they leave the floor conveyor, as shown in Fig. 6. Another floor conveyor, not shown, carries the washers through the priming and drying process in the paint room. All these assembly operations are carried on in the same room, simultaneously.

The greatest advantage of the newly installed conveying system is that it makes possible progressive assembly, with its attendant savings. At the plant of the Maytag Co. considerable floor space has been saved by using conveyors. The aisles are narrow, as no trucking within the department is necessary, and since the conveyors for the most part are overhead, stock bins are unnecessary, all of which saves a great deal of space.

Other advantages of this conveying system are that parts are always available for each operation; there is no noise and confusion from truck deliveries; the constant flow of material to the workmen makes it easy to increase the production; specialized operators quickly become expert in their operation; and finally, the production control is automatic, as the material flows in a definite direction and at a definite speed.

\* \* \*

#### SLIGHTING WORK

An experienced machine shop foreman once said that it takes a good man to know "when and how to slight work." That idea may shock mechanics who take pride in fine workmanship and strive for great neatness and accuracy, regardless, sometimes, of the practical requirements. Nevertheless, modern manufacturing practice is, in a sense, based upon the principle of slighting work.

It is evident that perfection is both impossible and unnecessary, and so we have, especially in connection with interchangeable manufacturing, systems of tolerances or allowable errors. The tolerance, then, represents work that is slighted, because it is useless to obtain greater accuracy than is needed to meet working conditions.

During the war many tolerances in connection with ordnance were, unfortunately, specified by those having authority but scant knowledge of the cost of unnecessary refinement. Extremely small tolerances were considered necessary, or perhaps the idea was to play safe, regardless of cost—

since accuracy often greatly affects cost. This close relationship between accuracy and cost is due to the fact that the degree of accuracy often controls the method and, consequently, the production.

A small steel block that is about 1 inch long may be cut from a bar very quickly by using some type of cutting-off machine, but if the allowable length error is small, a grinding operation may be necessary, and for much greater precision, lapping may have to follow grinding. The comparatively rough sawn block may be just as useful and effective for a given purpose as one of the greatest accuracy.

Some of the most competent and skilled workmen greatly lessen their value as producers by striving for a degree of finish and accuracy that has no commercial value whatever. Pride in the work produced is, in this instance, a decided handicap. Mere neatness and beauty of finish, as well as precision in workmanship often have, of course, real commercial value, but what has been said is intended to apply only to the "art for art's sake" idea which sometimes gets into the head even of an experienced mechanic.

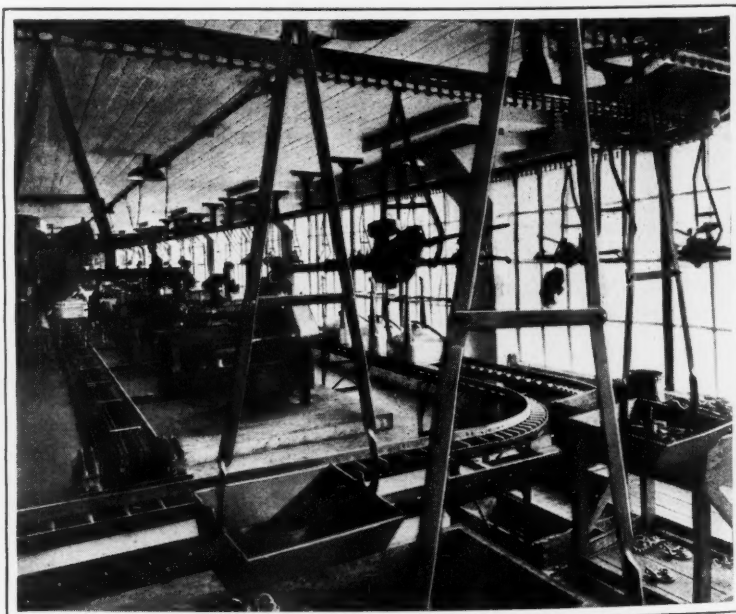


Fig. 4. Three Types of Conveyors; Two of these Carry Parts Ready for Assembly, and the Third is Part of the Assembly Line

## UNSTABLE FOUNDATIONS AS A CAUSE OF TROUBLE

By ROBERT J. BARROW

Occasionally we hear reports that "So and So's" gears or gear reduction drives do not work very well. It does not seem likely that the manufacturers of high-priced gears, gear speed reducers, and other high-grade mechanical appliances would send out products that are incorrectly designed or faulty in material or workmanship. As these products are used and tested by thousands of customers, it would seem more judicious to investigate the conditions under which they failed than to condemn them thoughtlessly. The foundations for machines of moderate size, for example, do not always receive the attention necessary to insure satisfactory operation.

Foundations for new machines are frequently provided by cutting through the floor, in two or more places, and allowing the cement columns to project through these openings. The spaces cut out in the floor for this purpose often vary in size and shape, so that the supporting area of the columns must vary accordingly. Old and well seasoned concrete bases or construction work is often used in conjunction with new concrete work to provide a machine bed. The new concrete or cement may be pronounced seasoned, but it is possible that a slow chemical action is still going on. These are only a few of the factors that may be responsible for throwing the machine out of alignment.

Crystallization and other internal changes may occur more or less intermittently in cement work for a considerable time before chemical stabilization has taken place. The observations of geologists indicate that rock formations which we ordinarily consider unchangeable are, in many cases, still in the process of stabilization. Changes which take place in cement foundations naturally upset the



Fig. 6. The Final Step in the Assembling Operations before the Conveyors Carry the Washing Machines to the Paint Room

alignment of the machines which they support. If the piers or columns differ much in size and if they are subjected to the action of heat, vapors, or electricity, the dimensions or volume of one pier may change considerably, as compared with another of the same design.

In designing a concrete pier, the forces which act upon it should also be considered. The direction in which the resultant force acts should be in line with a solid portion of the footing or base of the pier away from the edge. If care is not taken in this respect, the pier, although it may not fall over and may not tilt noticeably, may yet tilt enough to offset all the advantages of flexible couplings or close machining tolerances.

\* \* \*

## CANADIAN STEEL AND POWER SHOW

The largest exposition of its kind ever held in Canada will be staged in the University of Toronto Arena September 4 to 7, when Canada's Second Steel and Power Show will be held. The first exhibition of this character was held in September last year and aroused a great deal of interest among manufacturers and engineers. The products of over 250 firms will be shown.

Technical sessions have been organized, two on each of the four days of the exhibition, at which papers on important subjects in the mechanical engineering field will be read and discussed. These papers will especially cover industrial progress, plant efficiency and the lowering of production costs. The Canadian Section of the American Welding Society, the Montreal Chapter of the American Society for Steel Treating, and the Canadian Engineering Standards Association are among the organizations cooperating in the technical program. Campbell Bradshaw, National Meter Building, 24 Front St., West, Toronto, Ontario, Canada, is executive director.



Fig. 5. Completely Assembled Washing Machines Carried along Conveyor for Final Testing and Adjustment



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# What MACHINERY'S Readers Think

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Brief Contributions of General Interest are Solicited and Paid for

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## THE "TRADING-IN" OF OLD MACHINE TOOLS

The trading-in of worn-out machine tools when buying new equipment is an objectionable practice. The use of old machines is unprofitable and should be discouraged. Manufacturers and workmen alike, suffer in lost profits, lost time, and wages. When a machine cannot be used any longer without loss of time and production, why not offer it to the cupola? It is time to scrap it, when a machine can no longer be used to show profit. The practice of trading-in is uneconomical. It has all the aspects of bargaining, and somebody is sure to lose thereby.

There is a legitimate place for the sale of second-hand machinery. This type of equipment may be for sale for valid reasons, liquidation of businesses and the like, and many good purchases can be made; but it is entirely different in the case of a machine that has been used for twenty years or more and is worn out, which the buyer of a new machine wants to trade-in as a condition of the purchase. Trade-ins are not good business, and the machine tool dealers that have decided not to take used machines in trade are to be congratulated.

RAYMOND H. DAUTERICH

A manufacturer who will not purchase an improved machine because the machine tool builder or dealer will not take an old machine in trade, often fails to realize profits that might be earned from the use of up-to-date equipment. The old machine, if too valuable to scrap, can usually be sold to a dealer in second-hand machines. Even if it should be necessary to entirely scrap the old machine, it is generally found that the new machine produces sufficient savings to make this a profitable business move. On the other hand, there is a loss in the continued use of the old machine whenever a new machine can produce more cheaply.

In some shops there is a storage or "morgue" of obsolete machines. Frequently, parts from these machines can be used for replacements or in the building of some special equipment. Local jobbing shops, blacksmiths, and garages, when in need of a second-hand machine, frequently find something to meet their needs in this storage. Hence, something may be salvaged even from machines considered obsolete.

A. CADDIE

## TOOL MANUFACTURERS' ASSOCIATION

The need for concerted action on the part of die and tool manufacturers, as referred to on page 738 of June MACHINERY, is obvious. The present kind of competition in the tool industry discloses a very disorganized state of affairs. If the proposed association undertook its work before confidence had been established between the members, it is likely that the results would not be successful.

I would, therefore, suggest that, first, an association be founded that would devote itself to the promotion of acquaintanceship, standardization, cooperative advertising, apprentice training, etc. Only after the members have learned to know, respect and cooperate with one another in these activities can the question of fair competition and ethical methods of doing business be successfully dealt with. If confidence is not first established, the educational work to establish sound competitive methods would fail.

JOHN F. HARDECKER

The article on page 738 of June MACHINERY on the need of a tool manufacturers' association deals with a subject of great importance to the tool and die field. That the establishment of such an association would prove valuable is beyond question. All useful methods which are adaptable to the industry should be carefully and accurately compiled and information regarding them should be exchanged by the members. By cooperation and by free interchange of information relating to approved shop practices, costs may be reduced; and it is possible that a product might be finished in half the number of operations formerly required.

Production costs, however, are best determined by the individual manufacturer. The estimators should be selected from the ranks of the toolmakers, since their close association with the work enables them to make a more accurate estimate. Costs of materials and overhead expenses, of course, must be ascertained by the departments under whose supervision such estimates are prepared.

EARL L. FAIRALL

## IMPROVEMENTS IN ENGINE LATHES

Adding to the discussion of improvements in engine lathes, the writer would point to the fact that while the lever that connects the nut and screw, in most cases, must be pressed down for engagement, in other cases it is pushed up for that purpose. In nine cases out of ten, the operator favors the downward pressure, and I have seen jobs spoiled by very good workmen who, after having worked for some time on machines that have a downward movement, are suddenly called upon to operate a machine that has a lever with an upward movement. A standardization of this feature of the apron would be of great value.

The system of changing gears for screw cutting is becoming more and more a thing of the past. The efficient engine lathes of today require only the changing of the levers provided for this purpose on the gear-box to get the desired combination for producing almost all standard threads. I say "almost all," because 25 and 27 must now be considered standard threads, as they are used to a

great extent by the makers of electrical fixtures and of welding and cutting torches. To cut these threads, however, on the engine lathe, special gears must be made for the machine, and if they, too, could be obtained through the gear-box, it would be desirable.

These improvements may require expensive changes and may, therefore, be impracticable, but there can be no question that any reasonable improvement that makes for the saving of the operator's time also advances the efficiency of the machine, and all buyers prefer the makes that are the handiest to operate and that save changing from one job to another. **ALBERT MILTON THOMAS**

#### THE PROPOSED STANDARD TAPER SHANK

I believe that a standard taper would be of great value to the industry. From statistical information recently brought out at the meeting of the standardization committee having this work in hand, at Pittsburgh, it appears that 99 1/2 per cent of all tools made having taper shanks are provided with a Morse taper shank. In other words, the standardization has already been accomplished.

The Morse standard taper has practically become world standard, not through having been so decided upon by any standardization body, but by the adoption of it by users. I, therefore, believe that the next step is to officially designate the Morse taper as standard. In that event, the expense involved in any change would be small, as no great change would be necessary, usage having already made the Morse taper standard. **S. KUPPER**

#### INSTRUCTION FOR INSTRUCTORS

Commenting upon the article "Instruction for Instructors," in June *MACHINERY*, page 737, the writer believes that in teaching engineering, practically trained as well as theoretically educated instructors are required. By such instruction the young engineer will be better prepared to meet the obstacles in the field of engineering and thus obtain a broader education in his chosen line of work. It seems both logical and essential that the instructor should be required to obtain a certain amount of experience under actual practical conditions before he be permitted to serve as professor in an engineering school. Only under such supervision will the student be properly guided in his endeavors to obtain the education that he desires.

**WILLIAM T. VAN HORN**

#### ENFORCING SHOP RULES

In one plant, the principles governing shop rules may be summarized as follows: Each shop rule is carefully considered from every angle, both from the employer's and the employee's point of view. Lateness is recorded by quarterly periods. When it exceeds a permissible minimum, a warning is issued. If there is no improvement during the second quarterly period, the man is suspended for one day without pay. At the end of the third period, there is a suspension of three days without pay; and if there is no improvement at the end of the fourth quarter, the employee is dismissed.

Smoking, when prohibited in or around the plant, brings discharge at the first offense. Loafing, intoxication, and similar offenses are considered individually in accordance with the seriousness of the offense. A copy of all rules is posted conspicuously on the bulletin board of the shop.

No action is taken, however, without the man being heard. In each instance, he is permitted to show cause why the rule should not be enforced. The case is then dealt with in accordance with the facts as ascertained. Partiality is entirely eliminated in these proceedings, and unless the circumstances clearly warrant a deviation from the rules, they are enforced. **JOSEPH STROBEL**

#### WHEN SHOP RULES ARE TOO RIGID

It seems to me that a sharp distinction should be made between shop rules that apply to routine and those that involve safety. The reason for an administrative rule may not always be entirely clear to the workman, and hence, he may violate it unintentionally, without a proper understanding of the necessity for the rule. A great deal may be gained by explaining the need for the rule in such a case. This may save a valuable workman to the organization, and also open up to him a new viewpoint, as it may represent his first immediate contact with the reasons for the management's action.

Safety rules should be distinctly set off from the foregoing rules. They not only involve the individual's own safety and well being, but the protection of his fellow workmen as well. Their violation is serious and must not be tolerated, as the man who violates them is a menace to himself and the organization—an ever-present danger to his fellow workmen. To dismiss him is an act that may protect him in the future from his own carelessness. It protects and sets an example for his co-workers as well. It may seem harsh to dismiss him, but the situation seldom leaves any other practical alternative. **H. EISLEY**

#### APPRENTICE SUPERVISORS SHOULD HAVE HIGH IDEALS

The great majority of men in charge of apprenticeship training in our industrial plants are men of fine character, who set excellent examples for the boys. These men realize that, first of all, they must hold the respect of the apprentices under their supervision, if they wish to have full control of the boys and enjoy their confidence. They understand, too, that their talk and manners may have a lifelong effect on the boys for good or bad.

Some time ago, however, the writer came into contact with an apprentice supervisor who constantly indulged in oaths and vulgarity. It mattered not whether he was in the presence of apprentices or talking to them. Evidences of the disrespect the boys had for this man were apparent even to the casual visitor. The writer is not one who would rail against the mild use of profane words, but excessive profanity has never elevated a man except in his own estimation. Surely a person who must constantly resort to the use of objectionable language is not a fit teacher for our boys. **OLIVER HERBERT**



## ARE SERVICE REQUIREMENTS BECOMING EXCESSIVE?

Although the engineering service demanded by customers may seem excessive to equipment builders, the rendering of such service often furnishes the equipment manufacturer with new ideas for improvements. It also, in many cases, opens the door to the inner production circles of the purchasing company.

A good engineer who is able to help a customer overcome his troubles may at the same time study the requirements of the customer's plant and obtain ideas for the building of equipment by his company to meet the customer's needs. He will also discover weaknesses that are the most prolific source of service demands and will thus enable his company to build machines so designed that the requirements for service will be greatly reduced.

The buyer, of course, ultimately pays for all service, because its cost must be included in the overhead expenses of the equipment manufacturer. It is only just that the customer should pay for such service, either directly or indirectly, because he has the benefit of a machine that, if properly selected, should pay for itself many times over before it reaches the junk pile.

JOSEPH BELL

## ANOTHER CASE OF "SERVICE"

A manufacturer had bought a tapping machine from us having a speed-box with gears running in oil. We had advised him that only light oil ought to be used in the speed-box. One day he called us up from a distance of 400 miles to tell us that the speed-box heated up and asked us to send a service man. We told him over the 'phone to make sure that only light oil had been used in the speed-box, as the trouble was probably due to some heavy oil having been employed. In about an hour we received a telegram saying that the presence of a service man was necessary because of the heating of the speed-box. A service man was sent. He found the speed-box filled with heavy grease. After removing the grease, cleaning out the speed-box, and putting in light oil, no further trouble was experienced.

In view of the instructions given when the machine was delivered, as well as over the telephone, we did not feel that we were obligated to pay the expenses of our service man, so we sent a bill for his expenses, assuming the cost of his wages ourselves; but our customer even argued about paying the expenses. What is a machine tool builder to do?

OBSERVER

## FURNISHING TOOLS TO WORKMEN

Many machinists try to get along without complete tool equipment. This is especially true of the younger men who have not been in the trade any length of time. A full set of machinist's tools represents a heavy outlay of money, and for this reason are generally acquired through years of accumulation. There are some expensive tools that are used only on rare occasions and it is excusable if a machinist does not possess them.

The point the writer wishes to emphasize is this. Would it not be advisable for the shop to provide

the more expensive tools which the machinist uses infrequently? These tools could be easily stored in cabinets in the tool-room, and checked out to the workmen as are drills, cutters, etc.

I believe that in large shops there should be a "company store" where machinists' tools of the best quality could be on display in showcases and sold to the workmen. New men without proper equipment of tools could purchase what they need, and the cost of these tools could be deducted from their pay. This would benefit both employer and employee. Some tool manufacturer might be interested in this idea, as this would place his tools on display for those who use them and would also promote sales.

CHARLES H. MARTIN

## WHEN TO REPLACE MACHINE TOOLS

There are in use many serviceable machine tools of obsolete design that could profitably be scrapped to make space for machines of improved design. This fact is often overlooked, especially if the machine is operating satisfactorily and when competition is not too keen. The reason for replacing a machine tool, especially in production work, is most often due to obsolescence. In former days it may have been satisfactory to wait until a machine was worn out before replacing it, but at the present time this method is unsatisfactory.

The only successful method of finding out whether or not a machine can be profitably replaced is to make a complete analysis of the machines in the shop at regular intervals. This analysis should take into account the condition of the machine, the cost of upkeep, its production rate, and the labor required for operating it. The cost figures are then compared with those of the most improved machines available. Large concerns can well afford to employ competent men to spend their entire time on this work. No machine tool user can afford to disregard the advantages of improved machines, even though the present equipment may be in good condition, but of obsolete design. W. L. ROMICK

## MORE SHOP LIBRARIES ARE NEEDED

In providing a shop library for its employees, a company puts within their reach an opportunity to improve their knowledge of matters which have to do with the industry. Educational facilities of this kind are valuable not to the worker only, but to the company as well, as thereby a man's efficiency is increased. It also creates good-will.

Catalogues covering the company's own and similar lines of work should be available. Leading technical journals should be on file. These should be examined by the librarian and on a slip attached to each magazine should be written the names of the men who would be interested in certain articles, followed by the number of the page on which the article is to be found. After the magazines have made their rounds of the shop, the marked articles may be cut out and filed for future reference in snap binders, each binder covering some one subject. These articles should also be indexed and the binders should be available for the use of anyone, within the plant, that is interested.

GEORGE H. GUNN

# Special Tools for Railway Shops

## MACHINE FOR GRINDING-IN METALLIC PACKING FOR LOCOMOTIVE PISTONS

By M. H. HOWLETT, Grand Trunk Railway System

The machine shown in Fig. 1 is employed for grinding-in the contact faces of metallic packing for piston and valve glands and for gland rings such as shown in Fig. 2. The contact faces at A are required to form a steam-tight joint. Various methods are employed for grinding-in this joint, hand grinding being the most common, although it is a slow and laborious method. In some shops, the heavy gland B is mounted on a lathe spindle and revolved by power while holding the ring C in place by hand. The metallic ring, in this case, is mounted on a wooden block. Another method is to place the gland on a bench, locate the ring on the gland with the faces to be ground in contact, and revolve the ring by means of an air motor.

With the grinding-in machine shown in Fig. 1, the ring C, Fig. 2, is gripped in an automatic, cam-operated, chuck D, mounted on the motor-driven spindle E, while the heavy gland B is supported on a spring cushion plate F. After placing the gland B in position, the motor is started and the table G raised until contact is made between the surfaces to be ground-in, and sufficient pressure is exerted to slightly depress the four cushioning springs, one of which is shown at H. The table is then locked in this position. To remove the packing ring from chuck D when the grinding-in operation has been completed, it is simply

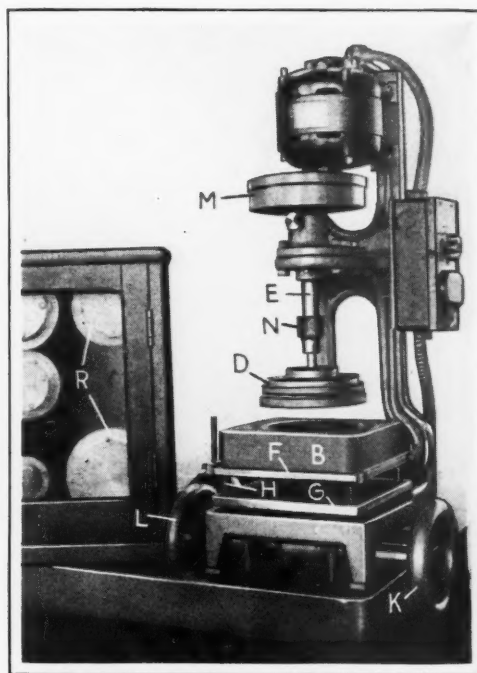


Fig. 1. Machine for Grinding-in Locomotive Piston Packing

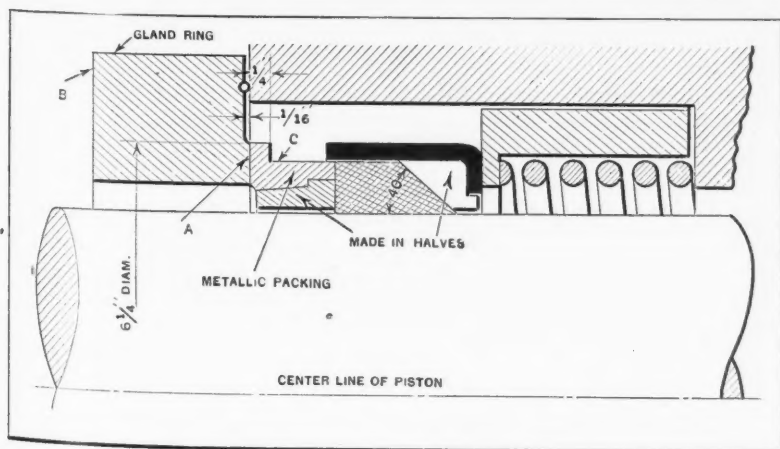


Fig. 2. Typical Piston Packing Ground-in for Steam-tight Fit at A on Machine Shown in Fig. 1

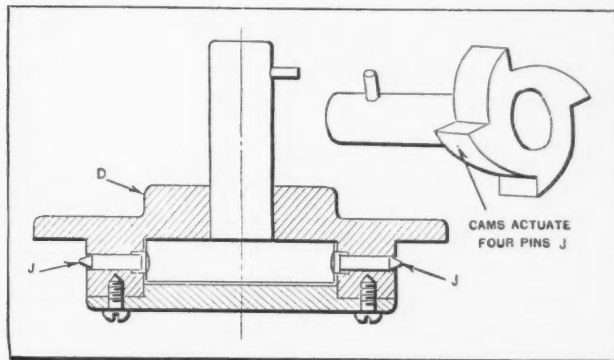


Fig. 3. Cam-operated Chuck for Holding Piston Packing Method of Holding Thin Work

necessary to turn the chuck body slightly in a direction opposite that of the driving spindle E. This allows the four cam-operated pins J, Fig. 3, to recede and release the work. It is obvious that the ground-in gland and ring can be quickly replaced by new work and that the grinding-in operation is quickly accomplished by the power-driven machine with a minimum amount of attention from the operator.

Table G, Fig. 1, is raised or lowered by operating the handwheel K, and is locked in any desired position by turning the lock-nut wheel L. A gear keyed to the shaft on which handwheel K is mounted transmits motion to table G through rack teeth cut on the projecting stem of the table. The grinding-in spindle is operated at a speed of 300 revolutions per minute. The drive from the 1/4-horsepower motor is transmitted through gears enclosed in the housing M. Chucks for holding packing rings of various styles and sizes are shown at R in the case at the left of the grinding-in machine. It will be noted that these chucks are secured to the holder N on spindle E by a bayonet slot which permits a quick change of chucks.

\* \* \*

## TOOL FOR ROLLING CAR JOURNALS

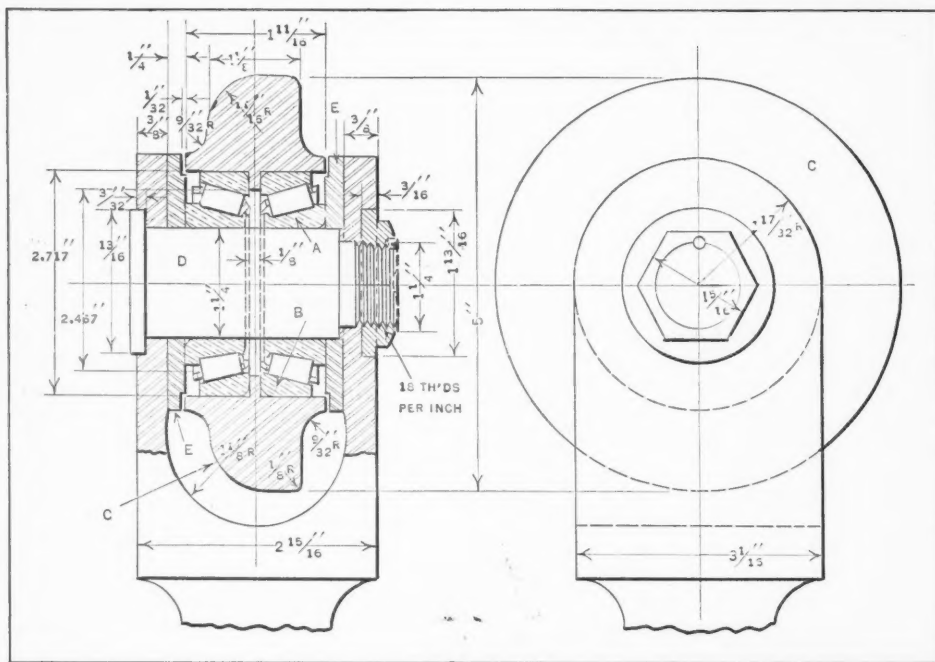
By G. E. BLACKSTONE, Chicago, Burlington & Quincy Railroad Co.

A rolling tool for use in rolling car journals, pistons, and crankpins is shown in the illustration. This tool is



The advantages of the roller bearing over the straight pin or plain bearing usually employed for such tools justify the additional expense. With the roller-bearing design, heavier pressures can be put on the roller, making it possible to complete the rolling of a piston or journal at one traverse of the roller, whereas two or more passes would be required with the plain-bearing tool. Also the roller does not heat up and stick, as often happens with the plain bearing.

The illustration shows how a line of shoes or a line of wedges may be set up in series for milling or planing. This arrangement increased production because of the saving effected in set-up time.



In the design illustrated, *A* and *B* show the cone and cup, respectively, of a Timken bearing. The roller *C*, pin *D*, and washers *E* are all made of high-speed steel, and are hardened and ground. The retaining nut on pin *D* is of steel, and is finished all over. The pin *D* is ground to a sliding fit in the cones and the washers. Cups *B* are a press fit in the roller, being located by an annular flange or washer machined in the bore of the roller.

The most important use of helium at present is for inflating dirigibles and passenger balloons, because helium is non-inflammable and its lifting power is but little less than that of hydrogen. It is also used extensively for filling toy balloons. Another application is in deep sea diving and caisson work, involving labor under abnormal pressure. It has been found that through the use of helium the danger of "caisson sickness" may be minimized.

By J. D. STEWART,  
Plant Engineer, Atlantic Coast Line Railroad Co.

[illegible]

904—MACHINERY, August, 1928

MACHINERY'S DATA SHEETS 135 and 136

TENTATIVE AMERICAN STANDARD SCREW HEADS

FINISHED HEXAGONAL CAP-SCREW HEADS						
Diameter of Screw, (All dimensions in inches)	Width Across Flats		Minimum Width Across Corners	Height		
	Maximum	Minimum		Nominal	Maximum	Minimum
1/4	7/16	0.4375	0.428	9/16	0.194	0.181
5/16	1/2	0.5000	0.489	15/64	0.242	0.227
3/8	9/16	0.5625	0.551	9/32	0.289	0.273
7/16	5/8	0.6250	0.612	21/64	0.337	0.319
1/2	3/4	0.7500	0.737	3/8	0.385	0.365
9/16	13/16	0.8125	0.798	27/64	0.432	0.411
5/8	7/8	0.8750	0.860	15/32	0.481	0.457
3/4	1	1.0000	0.983	9/16	0.576	0.549
7/8	1 1/8	1.1250	1.106	21/32	0.672	0.641
1	1 1/2	1.2500	1.229	3/4	0.768	0.733
1 1/8	1 5/8	1.3750	1.354	27/32	0.863	0.824
1 1/4	1 3/4	1.5000	1.477	15/16	0.959	0.916

Formulas

Width across flats of cap-screw heads shall be as follows:  $D = \text{diameter of bolt}$ .

Chamfered; angle of chamfer with top surface shall be 30 degrees; diameter of top flat circle shall be 100 per cent of the nominal width across flats.

Diameter of Bolt

1/4 to 7/16

1/2 to 7/8

1

1 1/8

1 1/4

Width Across Flats

$D + 3/16$

$D + 1/4$

$D + 5/16$

$D + 3/8$

$D + 7/16$

Tolerance on diameter of top flat circle shall be minus 15 per cent.

Cap-screw heads shall be at right angles to the body within 2 degrees and concentric with the body within a tolerance of 3 per cent of the width across flats.

Tolerance for width across flats shall be minus  $(0.015D + 0.006)$ .

Height of heads shall be  $2/4D$ .

Tolerance for height of heads shall be  $0.030D + 0.005$  from the minimum.

Minimum width across rounded corners of hexagon equals 1.14 times minimum width across flats.

The finished top shall be flat and

MACHINERY'S Data Sheet No. 135, New Series, August, 1928

CASTELLATED NUTS—WRENCH OPENINGS\*

HEXAGONAL CASTELLATED NUTS				
Diameter of Bolt (All dimensions in inches)	Width Across Flats		Nominal Thickness	Slot
	Maximum	Minimum		Width Depth
1/4	7/16	0.4375	9/32	5/64 3/32
5/16	1/2	0.5000	21/64	5/64 3/32
3/8	9/16	0.5625	13/32	1/8 1/8
7/16	5/8	0.6250	29/64	1/8 3/16
1/2	3/4	0.7500	9/16	5/32 3/16
9/16	7/8	0.8750	39/64	5/32 3/16
5/8	15/16	0.9375	101/16	5/32 1/4
3/4	1 1/8	1.1250	123/16	5/32 1/4
7/8	1 1/2	1.2500	147/16	5/32 1/4
1	1 5/8	1.3750	168/16	7/32 5/16
1 1/8	1 7/8	1.5000	189/16	7/32 5/16
1 1/4	2	1.6250	210/16	7/32 5/16
1 1/2	2 1/4	1.7500	233/16	1 1/4 3/8

Tolerance for width across flats shall be minus  $(0.015D + 0.006)$ . ( $D = \text{diameter of bolt}$ ).

Minimum width across corners equals 1.14 times minimum width across flats.

Nuts shall be washer-faced; the thickness of the washer face shall be  $1/64$  inch. The thickness of the nut shall be the distance from the top of the castellated nut to the bearing surface. The bearing surface of the washer shall be 100 per cent of the nominal width across flats. Tolerances on the diameter of the washer face shall be plus or minus 5 per cent.

The axis of the threaded hole shall be at right angles to the washer face within a tolerance of 2 degrees.

OPEN-END WRENCH OPENINGS

Basic Width Across Flats Bolt Heads and Nuts	Dimensions of Measuring Blocks for Wrench Openings		Basic Width Across Flats Bolt Heads and Nuts	Dimensions of Measuring Blocks for Wrench Openings		Basic Width Across Flats Bolt Heads and Nuts	Dimensions of Measuring Blocks for Wrench Openings	
	Maximum	Minimum		Maximum	Minimum		Maximum	Minimum
5/32	0.163	0.158	3/4	0.763	0.755	1 7/8	1.898	1.885
3/16	0.194	0.189	13/16	0.826	0.818	2 1/4	2.277	2.262
1/4	0.257	0.252	7/8	0.888	0.880	2 5/8	2.656	2.639
5/16	0.321	0.314	15/16	0.952	0.943	3	3.035	3.016
11/32	0.384	0.377	1	1.015	1.006	3 3/8	3.414	3.393
3/8	0.447	0.440	1 1/8	1.142	1.132	3 7/8	3.793	3.770
7/16	0.510	0.503	1 1/4	1.267	1.257	4 1/8	4.171	4.147
1/2	0.573	0.566	1 5/8	1.331	1.320	4 1/2	4.549	4.523
9/16	0.636	0.629	1 3/4	1.521	1.509	.....	.....	.....
5/8	0.699	0.692	1 7/8	1.710	1.697	.....	.....	.....

Wrenches shall be marked with the basic width (maximum width of nut) across flats as shown in column one.

\*Tentative American Standards

MACHINERY'S Data Sheet No. 136, New Series, August, 1928



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## Notes and Comment on Engineering Topics

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The Columbia River, the main outlet of the great Pacific northwest drainage area, is said to be able to produce about one-third of all the available water power in the United States.

Many of the alloy steels have been known only about thirty years or less. Vanadium steel, for example, has been known as an alloy steel only since 1896, when Helouis, a French investigator, published results of testing certain vanadium alloy steels.

The tendency toward the adoption of oil engines in place of steam engines for ship propulsion is evidenced by the fact that of 326 ships under construction in British and Irish shipyards at the end of last year, 232 were steamships, while 94 were oil-engined vessels. In horsepower, 406,000 was furnished by reciprocating steam engines; 202,500 by steam turbines; and 373,300 by oil engines.

What is probably the world's oldest automobile, in point of service, was recently acquired by the Automobile Club of Piccardy (France). This automobile was sold in 1891 and has been in continuous use for the last thirty-seven years. The machine is a Panhard Levassor, and was the sixth machine to be built by the French firm. It has been used every day for the last thirty-three years, and is claimed to be still "capable of running ten miles per hour on level roads." It has a V-type twin-cylinder engine, with hot tube ignition, wick carburetor, and is equipped with wooden wheels having iron rims.

An interesting type of flexible bolt has recently been placed on the market by the American Cable Co., Chicago, Ill. These bolts are intended to be used in places where rigid U-bolts are impracticable. They can be employed as auxiliary hangers for power shafts, for suspension of brackets, for scaffolding and tackle, and in any other places where a semi-flexible connection is satisfactory. The new flexible bolt has ordinary bolt ends, connected by a flexible wire rope. By a special method, the rope is slipped into holes in the bolt ends, which are attached and securely fastened to the rope. The convenience of such a flexible bolt is easily appreciated.

The steady growth of the machinery industry of Canada is indicated by the Canadian Industrial Census Statistics for 1926, recently issued. Exclusive of household and office machinery, the value of the products of the machinery industry in Canada in 1926 was \$29,553,000, an increase of 31 per cent over the output value in 1925. The number of machinery manufacturers was 156; of these, 116 were located in Ontario, 24 in Quebec, 10 in British

Columbia, 3 in Manitoba, and 3 scattered in other states; 9500 people were engaged in these factories. The capital invested was nearly \$60,000,000. Of the machinery manufactured, metal-working machinery was produced to a value of \$1,215,000.

While there was a decrease of 4,000,000 tons in the consumption of steel in the United States in 1927, as compared with 1926, there was an increase of 10,000,000 tons in production and consumption in the European countries. The consumption of copper in Europe in 1927 also indicates a restoration of more normal conditions abroad. Although the consumption of copper in the United States in 1927 was less than in 1926, the European demand was enough heavier to establish a new world record in copper consumption. The exports of copper from the United States during the early months of 1928 indicate a continuation of this demand. Increased consumption of other metals in Europe is also recorded.

Taxicabs of a new type, driven by electricity generated in the vehicles themselves, may soon be seen in city traffic. The Yellow Cab Co., of Philadelphia, cooperating with the General Electric Co., has built and tested several cabs so equipped and, while the development is still more or less of an experimental nature, the equipment has been worked out in detail to a point where successful operation can be assured. The already established successful and economical operation of gas-electric driven motor buses led to the first consideration of a taxicab with the same type of transmission. After the design and test of several cabs so equipped, a Willys-Knight model 70-A chassis was fitted with gas-electric transmission. A special gear reduction rear axle and taxicab body were built and installed, the conventional clutch and gear-box were removed, and the electric transmission put in place.

According to information obtained from the General Electric Co., the Dallas Power & Light Co. recently erected a forty-car garage from welded structural steel parts that would otherwise have been scrapped. The garage is made of steel angle-iron framework, covered with corrugated galvanized iron, and is in two units, each 16 by 140 feet, divided into ten spans, each 14 feet wide. The steel used in the framework of the garage was salvaged from the framework of an outdoor switching structure which became obsolete through the addition of generating equipment in the power plant. The different lengths of the steel members removed from this structure, together with the numerous holes already punched in them, would have made it necessary to splice or junk the greater part of the steel if welding could not have been used for joining the different sections.



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# Current Editorial Comment

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In the Machine-building and Kindred Industries

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## A NEW ERA IN CUTTING STEELS

About twenty-five years ago the introduction of high-speed steel revolutionized machine tool practice. Suddenly it became necessary to re-design many machines, and in many cases the metal-cutting tools themselves had to be changed in form.

Apparently we are about to enter another era in which new cutting materials will again cause great changes in machine shop practice. Both in America and Europe, extensive research work is being conducted with that end in view. Recently a new cutting steel was brought out in this country and a new cutting alloy appeared on the English market, both of which promise greater cutting performance than has so far been possible. The American product has been able successfully to machine manganese steel, a material so hard and tough that in the past it could be finished only by means of grinding. The British cutting alloy, in a test with a 1 1/4-inch square tool, removed metal from a nickel-chrome steel shaft of 285 Brinell hardness at the rate of 189 pounds per hour.

If these new cutting materials and others that are likely to be developed through the researches now being conducted, prove as successful in practice as these early tests indicate, the machine tool manufacturer will again be faced with the problem of building still more powerful machine tools to take advantage of the new cutting tools that the steel maker and the metal-cutting tool manufacturer may produce.

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## IS YOUR PROBLEM DIFFERENT?

Many manufacturers fail to utilize new improvements and discoveries that are made in the mechanical industry, because they believe the conditions in their shops are so different from those in other plants that the new machines or methods cannot be used to advantage. When the results obtained in other shops are mentioned, further consideration of the subject is often dismissed with the words, "Our problem is different."

There are instances where special conditions prevent the application of methods that have succeeded in other shops; but usually such cases are rare. The general manufacturing problems in shops making products fairly similar in size and in about the same quantities, as a rule do not differ to a great extent, and similar methods can be applied.

The opinion that problems and conditions are different, frequently results from a failure to understand the best way of applying the new machine or method. Possibly some practices should be changed and some old manufacturing methods revised, but before dismissing the consideration of a method that has proved economical and efficient under similar conditions elsewhere, would it not pay to investigate thoroughly every detail, with an open mind?

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## ECONOMICAL SECTIONAL STOCK BINS

Filing cabinets and bookcases for office use are now invariably made of the sectional type, so that a new uniform section can be added when needed. Stock-room bins and shelving for shop store-rooms are also available in sectional construction and the advantage of this is recognized by many progressive plants that have installed this equipment.

Every growing machinery concern finds that it is necessary to keep large quantities of parts on hand ready for assembling operations, and as the business increases more storage space is needed. When these additional facilities take the form simply of so much more shelving or storage space, a very haphazard arrangement usually results which causes loss of time.

The sectional stock-room bin system provides uniformity as the business grows, and makes it as easy to add more storage space in the shop stock-room as to add uniform letter files in the office. Manufacturers say that the effect on those who care for the stock is noticeable. The bins and containers themselves suggest order and uniformity, and the stock is stored away more quickly and neatly than formerly.

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## RESEARCH ON CUTTING LUBRICANTS

The research work on lubricating oils has been carried out so thoroughly in the automobile field that a definite grade of oil is specified for every car and for different seasons of the year. In the cutting lubricant field there is very little information on the best cutting lubricant for machining different materials. Probably there are certain lubricants that are most suitable for each particular kind of metal-cutting operation. Here is an opportunity for research work that would be of great value to the industry.

# The Economics of the Wage Problem

By JACOB D. COX, Jr., President and General Manager, Cleveland Twist Drill Co.

IN all human institutions, changes bring difficulties. Every new development finds certain people who can only with difficulty adjust themselves to it. The result is that all new things are under fire and criticism from those who have been made uncomfortable. In the last 150 years, industry has been undergoing a revolutionary transformation, affecting millions of men, and changing their status from independence to that of wage earners and employees. Naturally this has resulted in much resentment and discontent.

It is a strange thing that human nature, faced with the necessity of such changes, seldom thinks clearly about them. Modern psychologists tell us that a great deal of our thinking simply consists in finding more or less rational expressions for our prejudices and more or less intelligent arguments to support and reinforce our emotional predilections; so people, being made uncomfortable by industrial changes, have rushed to the conclusion that they must be bad, and seldom has any institution been a target for such bitter attack and widespread criticism as our modern large-scale organization of industry.

Nevertheless, it is a fact of common experience that in spite of such bitter opposition, and perhaps without being consciously desired or intended by anyone, industry has nevertheless gone on changing and developing in its own way, and in response to its own internal forces and laws, quite without regard to what people have felt and said about it. It would seem that in an age of science, people would have generally grasped the idea that such changes, coming in such an inevitable manner, were the result of fundamental forces and laws; and would have set about in the spirit of impartial and detached research to discover what these forces are and what lies behind them. One would think that such a study would have attracted many men of scientific temper to investigate phenomena so far reaching and intimately affecting the lives of all of us, but it seems to be a common fault of

human nature that most of us would far rather attack and berate what we do not like than make any endeavor to understand or evaluate it.

## What Determines the Wage Rate?

As the question of wages seems to be at the storm center of the entire controversy, one would naturally suppose that the influences governing wages would have been the subject of profound investigation, but as a matter of fact, it seems that this

has been one of the least studied and least understood of the topics dealt with by students of economics. Most of those who have written on the subject have apparently done so chiefly with the propagandist's aim, to bolster up the arguments of one side or the other, and reinforce old prejudices, rather than with any desire to secure new light from the time-tested methods of research; while those few who have approached the question with any pretense to scientific impartiality, have usually done so from a standpoint so academic and theoretical as to be practically without value for a work-a-day world. If the bitterness that marks wage controversies is ever to be assuaged, it must be through a reorganization of our fundamental



JACOB D. COX, Jr., President and General Manager, Cleveland Twist Drill Co.

ideas, on the basis of reality.

To the thoughtful employer, the first fact apparent in connection with wages is that they are based on supply and demand. When an occupation demands skill or experience of a type that is rare and it is important that the job be well done, the wage paid for that job will be high, but when work is of a character that almost any able-bodied man can do, without much previous training, then the wage for that work will be low. This seems to be almost the only factor that determines the scale of wages paid for various jobs in a country like the United States.

In some of the older countries of Europe and Asia, there are hard and fast lines of class and caste which make it very difficult for a man, no



matter how great his ability, to rise much above the status in which he was born, but in the United States, we may all be thankful that such barriers to advancement do not exist. The only thing that prevents any man from rising here is lack of ability or industry, and the higher paid jobs are higher paid solely because there are comparatively few men who are able to handle them effectively. The ease with which men of ability rise to affluence in American life is known to all of us and often commented on. Supply and demand alone seems to be the regulator in these matters, without interference from artificial social barriers. Thus the relative amounts paid for varying tasks are adjusted to the degree of scarcity of the kind of human material required and the importance attached to successful performance.

#### Why Do Wages in Different Countries Vary?

But while in all countries there is about the same relation between the rewards of the various classes, we find a very great variation in the general level of rewards between one country and another. It is well known that the average of wages and salaries in the United States is about double that of the most advanced countries of Europe, and about four times that of the most advanced Asiatic nation. While supply and demand, therefore, accounts for the differences of personal incomes within each nation, and results in a fairly similar graduation of returns in all of them, there yet must be some other influence creating the broad differences in level between one nation and another.

The relative differences prevailing today are approximately the same as those that existed before the war. The fact that these relationships have continued substantially unchanged through all that great upheaval must clearly indicate some controlling force that holds them in their true proportions. Clearly such forces must be sought in the conditions of international trade.

Modern transportation and communication have made the entire world one market place, and made us all the neighbors of one another. Prices of many articles have a world uniformity, and these articles include many of the most important to human existence. The market for wheat or cotton or wool is a world market, and depends on the conditions of supply and demand in many different countries.

The price of wheat is made at Liverpool, and a bushel of wheat delivered there brings its due price, regardless of what part of the world it was raised in. Needless to say, territories so far separated as Argentina and Russia, on the one hand, or India and Canada, on the other, have very different conditions of production. Harvest hands in Canada may receive \$5 or \$6 a day, while those in India or Russia may be paid but a few cents for the same amount of labor, yet the products of both bring the same price in the world market. It is clear that the production of Canadian harvest hands must be very much greater than those of the Orient, or it would be impossible for Canadian wheat to compete.

#### The Productivity of Labor Determines Wages

In this we seem to have the key to the problem, and expanding the application of the general situation existing in wheat to all other commodities

that figure in world trade, it appears that the level of wages existing in each country is dependent on, and roughly corresponds to, the general average productivity of labor in that country. If this were not so, the products of high-wage countries would be forced out of the world's markets by a flood of cheaper goods from low-wage countries, but the fact that each country holds its own due proportion of international trade must convince us that the wage level of each country is, in fact, adjusted to the average level of productivity of its labor.

The adjustment is one that is automatically accomplished, for if the wage level of any country gets too high, its market outlets will be narrowed and its people will experience unemployment, and under such conditions the market level of wages will decline until presently its products are able to compete again on even terms with those of other nations, at least to the extent necessary to absorb its surplus labor.

It appears, then, that the general average of productive efficiency is the determining factor in adjusting the wage level of each nation to the rest of the world, and all are held in harmony with each other by the automatic action of international commerce. The working of this law was never so apparent as in the alternating fluctuation of industrial prosperity and depression in the various European countries, as they passed through the successive phases of currency inflation and stabilization, which caused the rise or fall of their wage and price levels relative to other countries, on a gold basis. A whole volume might be written on this subject alone.

#### The World Wage Level

This statement gives no explanation of the forces that control the wage and price levels of the world as a whole. Presumably the supply of gold, or other metallic money, and the efficiency of the banking machinery, together with such exceptional incidents as wars, are the factors that regulate the world level of prices and wages. But it is not important for our purpose here that the working of these forces be traced in detail. It is sufficient if we understand that the high wage level of the United States is due to the high average productivity of labor here, while the lower wage levels of Europe and the Orient are due to the lower averages of productive accomplishment there.

[In two additional articles, to be published in September and October MACHINERY, Mr. Cox will deal with other phases of this important subject. The September article will be on the subject "Prices, Profits, and Wages"; the October article will cover "Industrial Prosperity and Fair Wages." —EDITOR]

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The exports of American cars in 1927 reached a figure of 640,500. This includes Canadian production of motor vehicles of American design supplying the Canadian market. The total exports of motor vehicles from the United States and Canada to other countries of the world, in the form of parts supplied to assembly plants in foreign countries and completed vehicles, amounted to nearly 520,000.

# Electric Drives for Machine Tools

By GORDON FOX, Electrical Engineer, and ARTHUR J. WHITCOMB, Assistant Electrical Engineer,  
Freyn Engineering Co., Chicago, Ill.

IN June MACHINERY, the general requirements for electric motor drives for machine tools were dealt with in an article beginning on page 767. In July MACHINERY, motor drives for lathes, boring mills, and milling machines were covered in an article beginning on page 831. The present article will cover motor drives for shapers, planers, and slotters. In September MACHINERY, the last article in this series, dealing with motor drives for drilling machines, grinding machines, punches and shears, will be published.

## Motor Drives for Shapers

In a shaper, reciprocating motion of the tool is obtained by a crank which is geared to the driving means and runs continuously in the same direction. Constant-speed motors may be used in connection with a gear-box for obtaining a change in cutting speeds. The adjustable-speed, direct-current motor, however, is a preferable drive. A wide range of speed adjustment is desirable. This may be obtained in a motor having a 4 to 1 speed ratio. The armature shifting or variable air gap type of direct-current motor is also successfully employed for motor drives of this general character.

A drum controller may be used for controlling the shaper motor, provided room can be found for installing it where it can be easily manipulated by the operator. Such a controller should be non-reversing and should provide dynamic braking in the "off" position, enabling the operator to stop the tool quickly while it is disengaged from the work. When a drum controller cannot be conveniently located, a push-button-operated magnetic control with separate field rheostat may be used.

When only alternating current is available, the shaper may be driven by a squirrel-cage motor in conjunction with a gear-box for changing speed. A better arrangement would be a four-speed squir-

rel-cage motor without the gear-box, but with a drum switch for changing speeds. A wound-rotor motor is unsatisfactory for variable-speed service on a shaper. For controlling the alternating-current motor, a magnetic type of primary resistance starter will be found preferable to other types, for it is frequently desirable to jog the tool.

Tables 1 and 2 give the motor capacity required by different sizes and types of shapers.

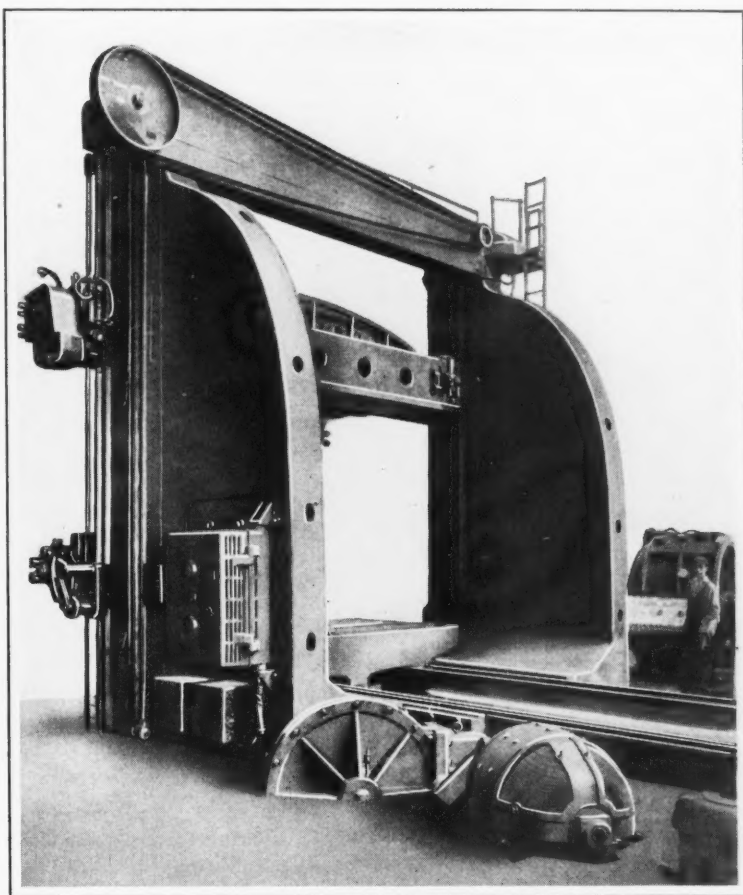


Fig. 1. Planer Driven by a 75-horsepower Reversing Direct-current Motor with Reversing Controller Mounted on Housing of Planer

## Motor Drives for Planers

Planers are variously equipped. The most simple drive is a constant-speed motor provided with a flywheel, reversal being obtained by belt-shifting with straight and crossed belts. With this arrangement, belt troubles are frequent, because the narrow belts, necessary to easy shifting, stretch and wear rapidly under the severe reversing service, particularly when taking short strokes.

Belted planers are often arranged with a single cutting and a single return speed. In some cases, a cone pulley is provided to afford a number of cutting speeds, but only one return speed is

available. In order to gain a little more flexibility with a belted machine, an adjustable-speed motor may be utilized. This motor has two field rheostats connected in parallel, one being alternately cut in and out by means of tumbler switches actuated by the platen. One rheostat governs the cutting speed, and the other the return speed. The two speeds are thus more or less independently adjustable. The speed range afforded is about 2 to 1.

Belt drive is particularly adapted for small planers of 36 inches and below. The cost of direct drive is relatively high on these small machines, and the advantages and savings of direct drive are less pronounced. For all but the smallest planers, direct-connected reversing motor drive has been fully developed and is now practically standard. It pro-



vides independent control of cutting and return speeds. It provides fast and accurate reversals. It eliminates belt slip, permits heavy cuts to be taken, and affords better control for setting up work.

Several of the motor manufacturers build special motors for reversing planer duty. These motors have armatures of small diameters to minimize inertia. This is a factor of some importance, as the inertia of the motor armature ordinarily constitutes a large part of the total inertia of the drive. These motors are of the adjustable-speed type, with a speed range of 4 to 1. Some builders incorporate a compound winding to assist in reversing. Magnetic control is essential. The master switches are mounted on the bed of the planer, and are tripped by movable dogs on the platen. The automatic operation is subject, however, to a start and stop station controlled by the operator. The operator is also provided with a pendant start, stop, and reverse switch independent of the platen master, which is used for setting up.

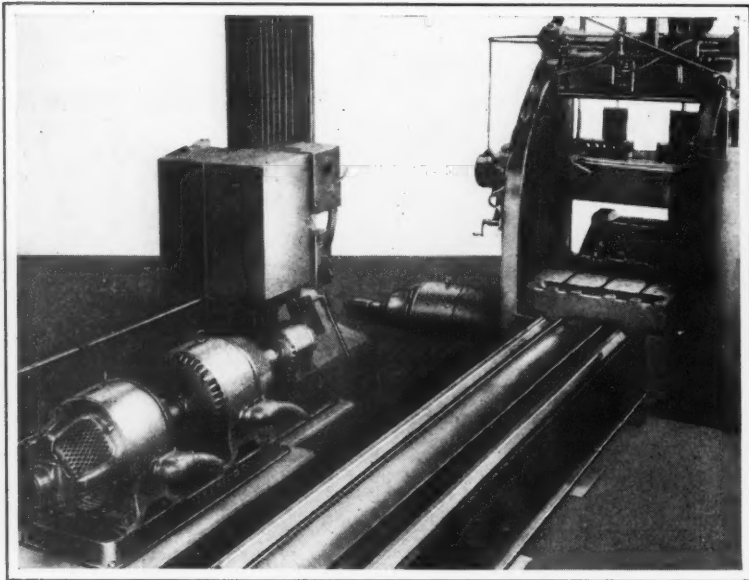


Fig. 2. Planer Driven by a Motor-generator Set with Exciter (Seen at the Extreme Left). Variable Voltage is Supplied to the Reversing Motor in the Center, which Drives the Planer

Separate field rheostats are provided for adjusting the cutting and return speeds. The cutting speed range is usually about 25 to 60 feet per minute, and the return speed range, 50 to 100 feet per minute. Ordinarily, it is desirable to have the return speed as high as the length of stroke permits, but a slower return speed may be essential with large or top-heavy castings. It is possible to have any combination of cutting and return speeds within the limits of the motor and rheostats.

There are two common methods of control. One provides simple plugging for reversal while running, and the other introduces dynamic braking to decelerate the motor before reversing. Individual manufacturers vary somewhat in detail practices. Two representative designs of these respective types will be discussed or compared, with particular reference to the features in which they differ and the limitations of each.

#### Speed and Smoothness of Reversal

In general, the plugging type of control is decelerated and stopped faster, because the reversed

Table 1. Motor Capacity Required by Standard Type Shapers

Stroke of Shaper, Inches	Horsepower of Motor	
	Medium	Heavy
16	2 to 3	3 to 5
20	5	5
24	5 to 7 1/2	7 1/2 to 10
28	5 to 7 1/2	10
32	5 to 7 1/2	10

Machinery

torque is maintained down to and through zero speed. In the matter of acceleration, the two types are identical. The plugging type has a series resistor of high ohmic value, but the excess or plugging step is short-circuited at the instant of reversal, placing the two types on a par. The time required to transfer from dynamic braking to reverse acceleration compares with the time required to short-circuit the plugging step of the resistor.

During this brief interval, the plugging type is developing a reversed torque of reduced magnitude. To this extent, reversal and acceleration are more rapid with the plugging type of controller.

The plugging type of control also affords slightly smoother reversal, since the reverse torque is continuous. Backlash may occur with dynamic braking control at the interval when braking is discontinued and reversed accelerating torque applied.

#### Stopping Upon Failure of Power

The dynamic braking controller is arranged to excite its own shunt field by armature counter-voltage in case of power failure. The resistance of the dynamic braking circuit is reduced to a low value, so that a very quick stop is obtained. Owing to the fact that the armature counter-voltage maintains the shunt field for one direction of rotation and opposes it for the other, this independent dynamic braking effect is available for one direction of rotation only. It is arranged that the braking be effective on the return stroke. If power fails on the cutting stroke, the cutting load will ordinarily stop the planer quickly. If power should fail at the instant of reversal, over-travel is possible. This is not a likely occurrence with a dynamic braking controller, as there is no current peak incident to reversal until the planer is stopped; hence there is no tendency to trip the circuit-breaker due to reversing current.

Deceleration by plugging requires an external source of power; hence this method is ineffective

Table 2. Motor Capacity Required by Traverse-head Shapers

Stroke of Shaper, Inches	Horsepower of Motor	
	Medium	Heavy
18	5	7 1/2
22	7 1/2	10
26	10	15

Machinery

Table 3. Motor Sizes for Planers

Width of Planer Bed, Inches	Height under Rail, Inches	Horsepower of Motor
24	24	5
27	27	5 to 7 1/2
30	30	7 1/2 to 10
36	36	15 to 20
42	42	15 to 20
48	48	20 to 35
60	60	35 to 50
72	72	35 to 50
84	84	35 to 50
96	96	50

Machinery

in case of power failure. The plugging type of controller is therefore arranged to utilize dynamic braking in case of power failure. In this controller, however, the shunt field is connected ahead of the circuit-breaker, which opens when the voltage falls to 70 per cent of rating. It is then assumed that sufficient voltage will be maintained on the shunt field by the counter-voltage of other motors on the system to afford dynamic braking action for both directions of rotation. This arrangement is generally satisfactory if other motors on the system are operating at the time of power failure. The plugging type of controller is not unlikely to trip its circuit-breaker at the end of travel and the instant of reversal, due to current peak.

#### Failure to Reverse

In case one set of directional contactors "freezes" closed and fails to open with a dynamic braking controller, the reverse contactor closes, causing a short circuit which opens the circuit-breaker contactor and sets up dynamic braking action. In the case of the plugging control, the directional contactors are interlocked. Failure of one set to open, automatically holds the other set open and causes over-travel. To prevent this occurrence and avoid the possibility of welding closed, carbon to copper contacts are used. It should be noted that the braking contactors of a dynamic braking controller are not called upon to open any appreciable current. In a plugging control, the stopping is normally done by the directional contactors, which are subject to more or less arcing and wear.

Both dynamic braking and plugging controls are provided with dynamic braking stop in connection with the operator's switch, the action being closely parallel. An appreciable advantage is afforded by the dynamic braking control in that the action while setting up is duplicated while running, thus facilitating the setting up process. The two types are equivalent in the matter of stopping between the ends of travel for gaging in that they both utilize dynamic braking for this purpose. If plugging were used, there would be danger of reversal, causing a false action of the tool feed.

Table 4. Motors for Slotting and Keyseating Machines

Stroke of Machine, Inches	Horsepower of Motor
6 to 8	3 to 5
10 to 12	5
14 to 16	5 to 7 1/2
18	7 1/2 to 10
20 to 30	10 to 15

Machinery

#### Variable-voltage Direct-current Drive

Variable-voltage control has been successfully applied to planer drives and offers advantages under some conditions. The outfit consists of a reversing planer motor, a motor-generator set for supplying power, a controller for the field contactors, field rheostats for independently adjusting the cut and return stroke speeds, an armature circuit contactor, a master switch operated by the motion of the planer table and a pendant switch. The generator fields are reversed to obtain reversal of rotation of the planer motor.

The cutting speed is controlled by adjusting the generator voltage. The return speed is obtained with full generator voltage, the motor field being weakened to secure the desired speed. Each rheostat affects only its respective direction of travel. The master switch and pendant switch function in the same manner as with constant-voltage control.

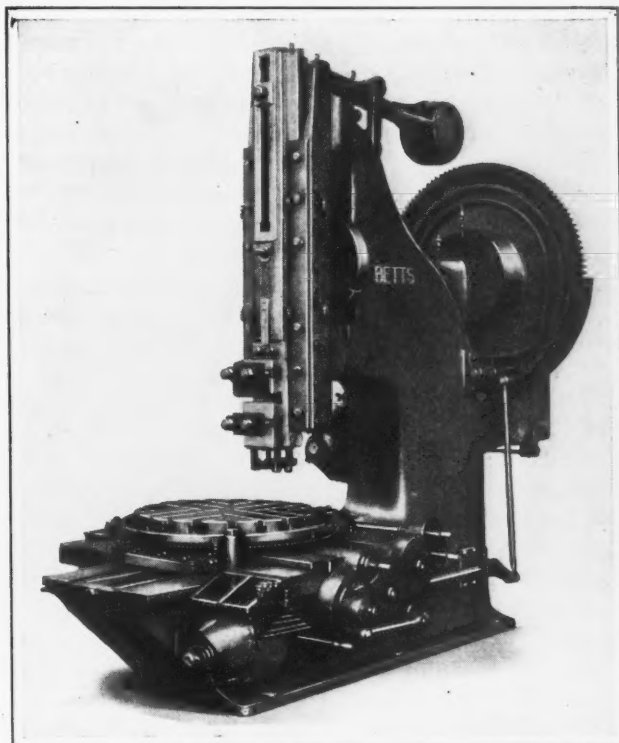


Fig. 3. Motor for 16-inch Crank Slotter Mounted on Side of Column (One End Bell of Motor being Visible). A Similar Motor Located Near the Base Drives the Table

The motor-generator set, which provides power for the reversing motor, is commonly equipped with an alternating-current driving motor, as the majority of variable-voltage installations are made where direct current is not available. An exciter is included to furnish a suitable source of excitation for generator and motor fields.

The control equipment for variable-voltage drive is relatively simple. The main circuit between the generator and the planer motor is not opened except by overload. The control contactors handle only small field currents. Variable-voltage control affords a speed range of 6 to 1 or even greater. With normal ratios of planer gearing, this will give a minimum cutting speed of 20 feet per minute, and a maximum return speed of 120 feet per minute or higher.

Variable-voltage drive offers these advantages:



1. A greater speed range than is available with constant-voltage drive.

2. Smooth reversal and acceleration at high speeds, resulting in less wear on the planer and less jar to the work, the latter being securely held, even at high speeds.

3. Accurate stop at ends of the stroke, combined with rapid reversal and acceleration. There is no resistor in the armature circuit to delay acceleration if the tool starts to cut before the motor is up to speed.

4. Power for emergency braking supplied by inertia of motor-generator set in case of failure of main power supply.

5. Simple control equipment, with minimum contact wear and no rheostatic losses.

Variable-voltage drive has the following disadvantages:

1. A separate motor generator set, or at least a separate generator, is required for each planer.

2. When working at low speeds, the load that can be carried is reduced because of the reduced voltage. The motor has a constant torque characteristic, and is not able to handle heavier cuts at reduced speeds.

3. There are conversion losses in the motor-generator set. These are comparable with the losses commonly associated with conversion from alternating to direct current.

4. The first cost is higher in some instances.

In general, variable-voltage drive may well be considered when only alternating current or 500-volt direct current is available, when only one or two planers are installed, when a greater speed range than 4 to 1 is desirable, or when very smooth reversals are necessary because of the shape of the work or perhaps the high speed. Wound-rotor induction motors equipped with magnetic control have been applied to direct-connected reversing drives for planers. They are not equal in performance to the direct-current drives, either in speed or in flexibility of control.

For raising and lowering the cross-rails of planers and boring mills and also for moving the tailstocks of large lathes, special heavily compound-wound direct-current motors are available. These are operated by drum control. They are designed to develop high starting torque. Most large planers are provided with separate motors which raise and lower the cross-rail. In some machine of recent design, the cross-rail has been utilized for power traversing and feeding of the cross-rail heads and side-heads, as well as for raising and lowering the cross-rail.

In these machines, the cross-rail motor is controlled from the pendant switch and also from the table dogs. In setting up work, it is controlled from the pendant switch. During operation, it is controlled from the table dogs and is energized at the end of each stroke to accomplish the feeding. Interlocking is provided between the cross-rail motor and the main driving motor, so that the table cannot be started while traversing and so that it is impossible to traverse while the table is moving. Utilization of the cross-rail motor for feeding has simplified the feed mechanism. It is further stated that time is saved in that the period of reversal of

the table is utilized in feeding the heads. Motor sizes for planers are given in Table 3.

#### Motor Drive for Slotters

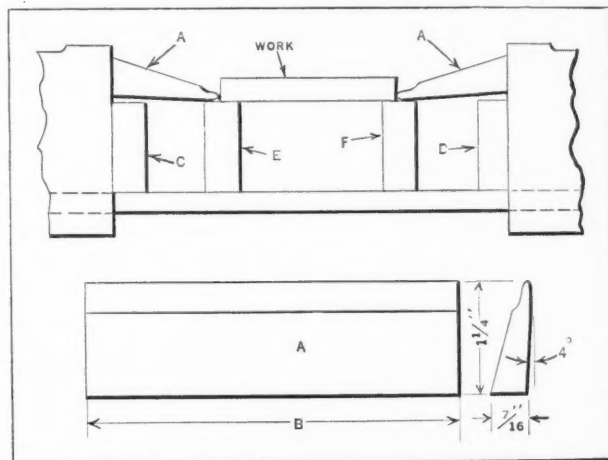
The operation of a slotter is similar to that of a planer, except that the stroke is shorter. For crank-operated slotters, constant-speed drive, using shunt-wound direct-current motors or squirrel-cage induction motors, is more common. Adjustable-speed direct-current motors are sometimes employed. Reversing drive, similar to planer practice, is used more particularly for gear slotters. Table 4 gives some motor sizes listed for standard slotting and keyseating machines.

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#### HOLDING THIN WORK ON SHAPER

By GEORGE W. WILSON

A shop kink that has proved a great time-saver on certain kinds of shaper work is shown in the accompanying illustration. In planing comparatively thin work on the shaper, difficulty is generally experienced in making the piece lie flat on the par-



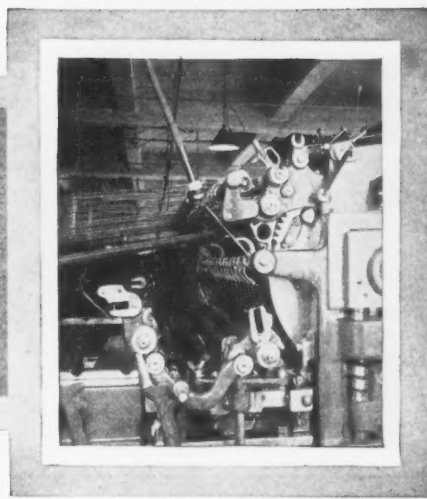
Method of Holding Thin Work

allels when the vise jaws are tightened. The side of the work in contact with the movable jaw always has a tendency to rise, and as a result, is planed thinner than the opposite side. Without some clamping arrangement, such as shown in the illustration, it is necessary to use a pair of parallels of just the right height to bring the top of the work above the vise jaws.

The hold-down jaws A are preferably made as long as the vise jaws are wide. The ones used by the writer were planed from untempered tool steel, although mild steel will serve equally well. In clamping the work, it is better to use four parallels, only two of which, namely those shown at E and F, need to be of the same height. The other parallels C and D merely serve to support the clips until the vise jaws are tightened. The bevel at the back of the clips causes them to assume the position shown in the upper view of the accompanying illustration when the vise jaws are tightened, thus giving a firm downward clamping pressure on the work. This method of clamping allows sufficient clearance for the tool, regardless of the height of the work. The clips are equally well adapted for holding work that is placed directly on the bottom of the device shown.



## Ingenious Mechanical Movements



### UNIVERSAL JOINT

By ELBERT J. BURNS

The universal joint here illustrated is designed to provide large bearing surfaces and strength. The principal parts are the driving shaft *A*, the two half shells *B* and *B*<sub>1</sub>, a two-part housing *C*, and a driven shaft *D*. Surface *E* of the driving shaft is spherical, and it has parallel conical seats *F* and *G* which allow shaft *A* a movement in, let us say, a horizontal plane.

The two spherically formed half shells *B* and *B*<sub>1</sub> (see also detailed view in lower right-hand corner) have conical faces which correspond to the conical seats *F* and *G* on shaft *A*. Shells *B* and *B*<sub>1</sub> also have annular flanges *H* located at right angles to the conical surface, thus allowing a movement of shells *B* and shaft *A* in a vertical plane.

The two-part socket *C* is made to receive the driven shaft *D*. This socket has annular slots into

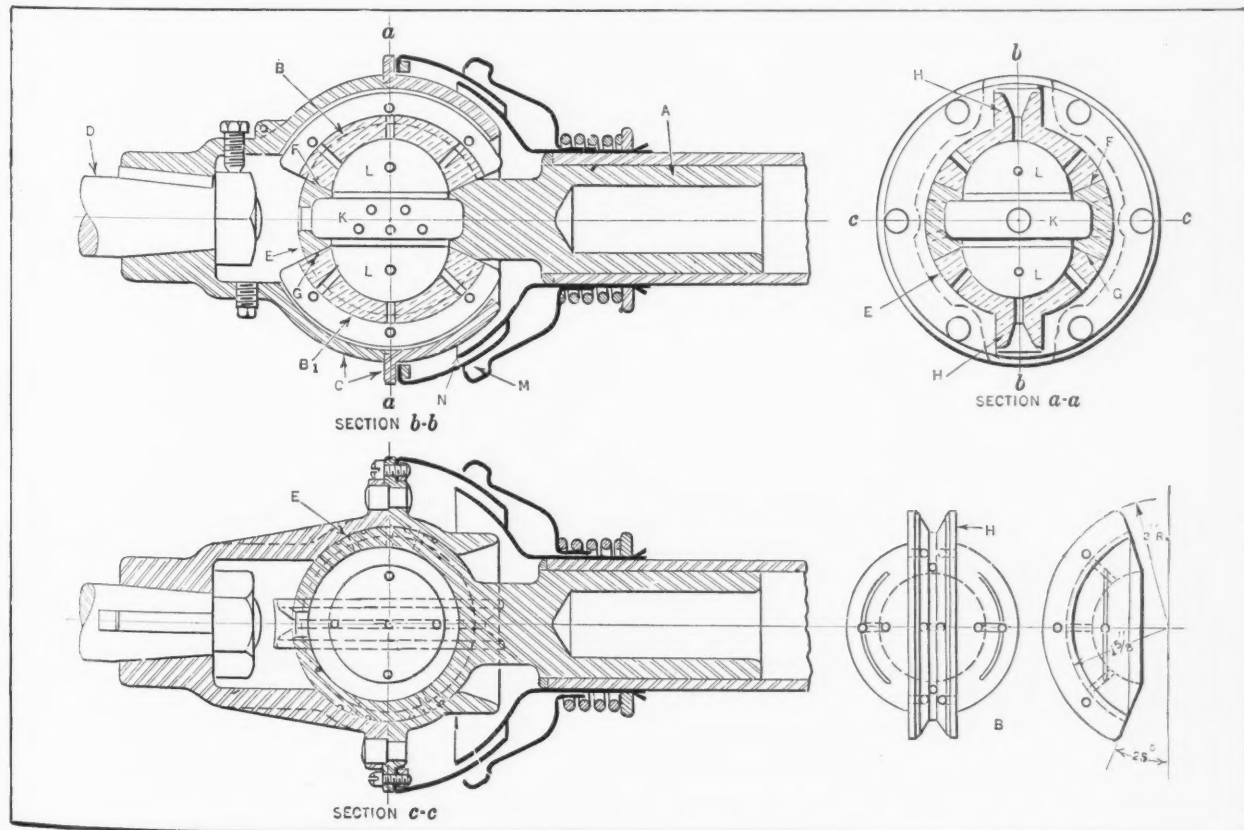
which flanges *H* fit. The combined movements of shaft *A* and half shells *B* give the desired universal movement.

The cavities *K* and *L* provide a storage space for lubricating grease, and this lubricant is distributed to the bearing surfaces through small holes connected with oil-grooves. The parts *B* are made of phosphor-bronze, part *A* of chrome-nickel steel, and part *C* of drop-forged steel. At *M* there is hemp packing, and at *N* cork is cemented to the outer shell. This universal joint applied to a Hudson car proved satisfactory during a 30,000-mile test.

### SPEED VARIED EACH HALF REVOLUTION

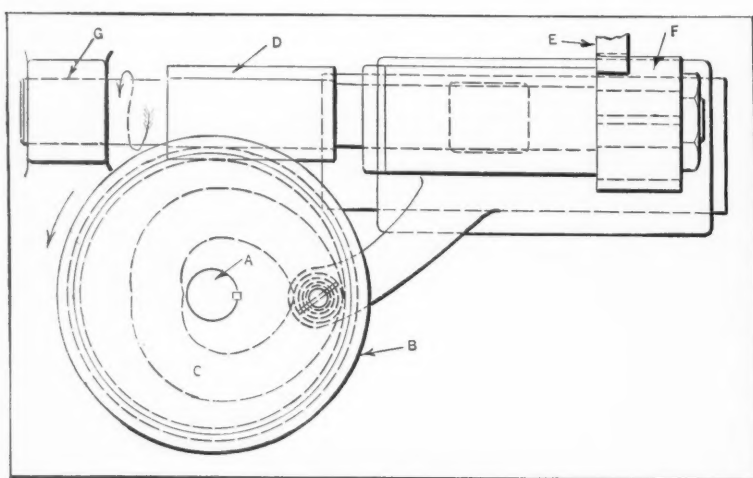
By J. E. FENNO

An electric switch testing machine required that shaft *A* (see illustration) make one-half revolution in three seconds at a uniform speed, and the following half revolution in four seconds, also at a uni-



Universal Joint Designed to Insure Strength and Durability





Mechanism for Changing Speed of Driven Shaft Every Half Revolution

form speed. This result is obtained by means of a cam *C* (on the driving worm-wheel *B*), which imparts a uniform reciprocating motion to the driving worm *D*, causing the worm-wheel alternately to be advanced and retarded as the worm moves first with and then against the worm-wheel rotation.

The mechanism is driven by gear *E*, which meshes with pinion *F*. This pinion is attached to the worm-shaft and is wide enough to provide for the lengthwise movement of the worm. The worm-wheel *B* and cam *C* are integral. The cam roller is carried by an arm which is part of the slide that form a bearing for one end of the worm-shaft. The other end is supported in bearing *G* through which it is free to slide when the worm is moved axially.

Worm-wheel *B* has 56 teeth and worm *D* has 4 threads per inch. The speed of worm *D* is 8 revolutions per second. When shaft *A* is being turned one-half revolution in three seconds, the worm moves with or in the direction of rotation of

the worm-wheel *B*, so that *B* is turned somewhat faster than it would be if worm *D* were not moved axially. The increased movement causes shaft *A* and worm-wheel *B* to turn one-half revolution in one second less than when worm *D* moves backward against the rotation of worm-wheel *B*.

Since worm *D* makes 8 revolutions per second, there are 24 revolutions in 3 seconds, and at the same time the worm advances one inch due to the action of the cam. Now the pitch of the worm thread and circular pitch of the worm-wheel is  $\frac{1}{4}$  inch; hence, 1 inch axial movement of the worm is equivalent to 4 teeth of the wheel, so that the total movement equals  $24 + 4 = 28$  teeth, or one-half revolution, as the wheel has 56 teeth. When worm *D* moves backward against the rotation of the

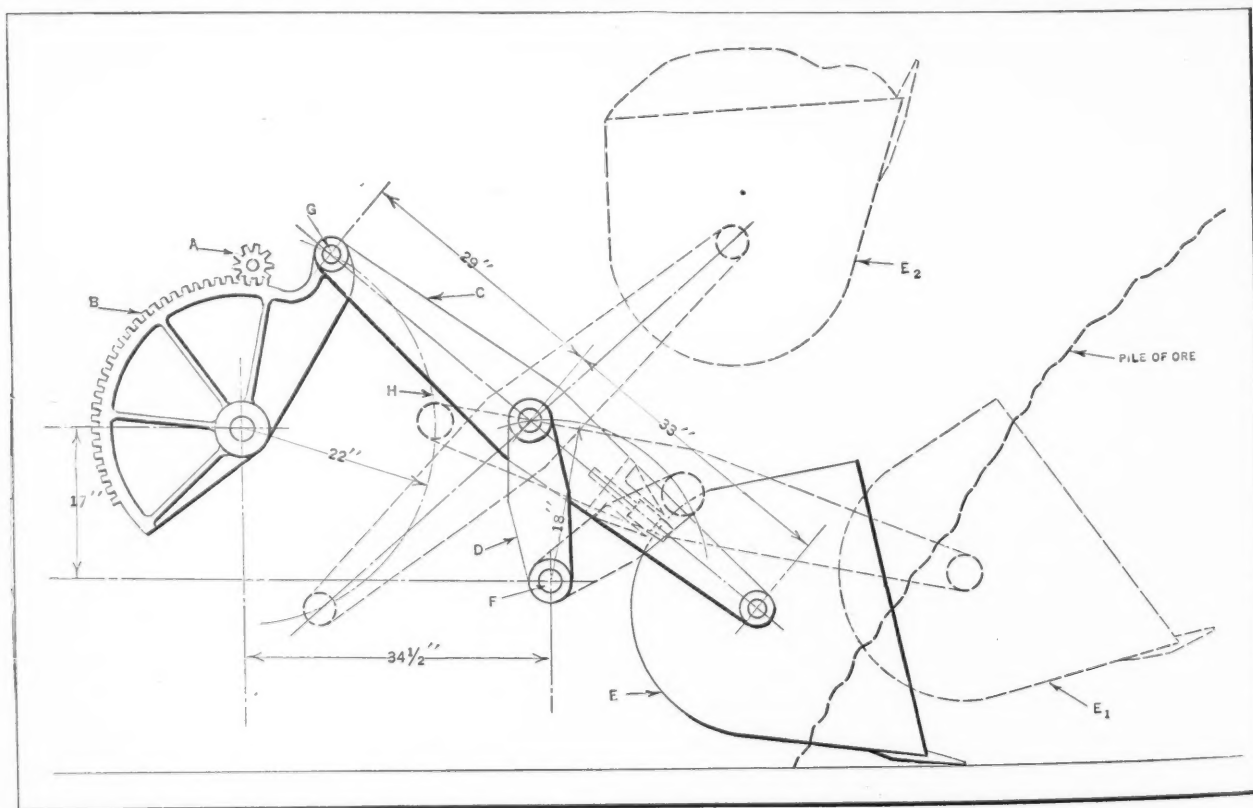
worm-wheel, it makes 32 revolutions in four seconds, but the 1 inch axial movement, in effect, subtracts motion equivalent to 4 teeth, or  $32 - 4 = 28$ , or one-half turn in four seconds, as compared with three seconds for the opposite direction.

## MECHANICAL SCOOPING MOTION

By B. ULINSKY

A mechanically reproduced scooping motion incorporated in a truck designed principally for handling lead ore is illustrated by the accompanying diagram, which merely shows those parts that are essential to the motion required. Pinion *A*, which is driven by a motor, meshes with the gear sector *B*. Arm *C* is pivoted to one end of gear *B*; the other end is pivoted to bucket *E* and the middle part of arm *C* is pivoted to rocker arm *D*, which swings about a fixed pivot *F*.

This combination, when proportioned according



Scooping Mechanism for Shovel Truck

to the dimensions given, provides the required scooping action. The truck is driven forward to locate the bucket close to a pile of ore. Then as pinion *A* turns gear *B*, pin *G* moves downward along arc *H*, and the bucket *E* is forced into the pile, as at *E*<sub>1</sub>, at the same time being forced upward with an efficient scooping action similar to that obtained with the large steam shovels. The dotted lines at *E*<sub>2</sub> indicate the elevated position of the bucket when loaded.

This mechanism has proved to be a great time- and labor-saver, as the truck loads itself and at the same time lifts the ore high enough so that it can readily be charged into the furnace. The truck is also very compact, so that it can be run into a freight car for unloading. The complete mechanism permits sluing the loaded bucket 90 degrees each way from the central position, so that the truck can be run up a narrow aisle for charging furnaces with the ore.

## BULLDOZER CAM MECHANISM

By LOUIS KADAR

A very simple cam mechanism for transmitting motion to the slides of multiple-slide bulldozers is shown in Figs. 1, 2, and 3. This type of mechanism may be applied without altering the machine, and is intended for use when several slides are required for bending irregular shapes.

The push-bar *A*, Fig. 1, is connected to the bulldozer cross-head, and engages the circular edge of driving cam *B*, which is free to swing about pin *C*. This cam is connected with slide *E* by link *D*, but during the working stroke, the circular end *F* of cam *B* is in contact with slide *E*, so that the latter is operated by the direct thrust of the cam. There is a slight amount of play in the connection between link *D* and slide *E*, so that the link is not under load during the bending operation. The re-

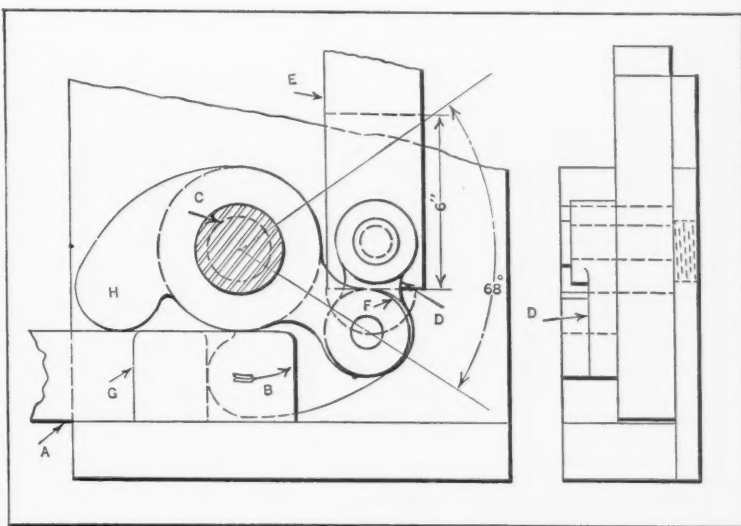


Fig. 1. Cam Mechanism with Tool-slide at Right Angles to Push-bar

turn stroke of push-bar *A* brings lug *G* into contact with the backing or reverse cam *H*, and then slide *E* is withdrawn by connecting link *D*. At the end of both forward and return strokes, bar *A* slides under the curved ends of cams *B* and *H*.

Fig. 1 shows the arrangement for a right-angle or 90-degree drive. The working stroke of the slide is 6 inches, and the angular movement of the cam 68 degrees. Fig. 2 shows a 45-degree drive. The stroke is also 6 inches, and the angular movement of the cam 79 degrees. A reverse drive is shown in Fig. 3. The length of stroke is the same as in the preceding examples, and the angular movement 73 degrees. The length of the stroke and the design of the parts depend, of course, upon the bending operation and the size of the stock.

This type of mechanism, varied somewhat as to proportions, has been applied to fourteen cams in a No. 7 bulldozer. These cams have a working stroke of from 2 to 6 inches, and are being used for bending 7/8-inch round spring steel. All the bearing surfaces of the cam drive are hardened.

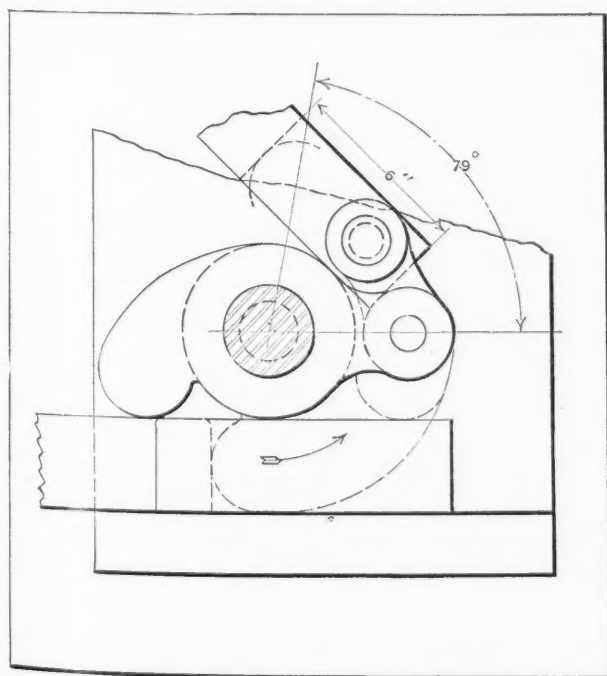


Fig. 2. Cam with Tool-slide in 45-degree Position

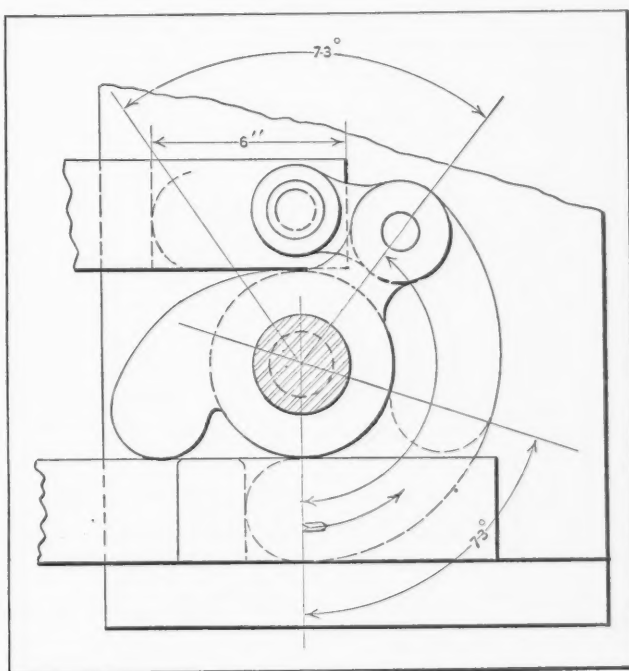


Fig. 3. Cam Applied to a Reverse Drive



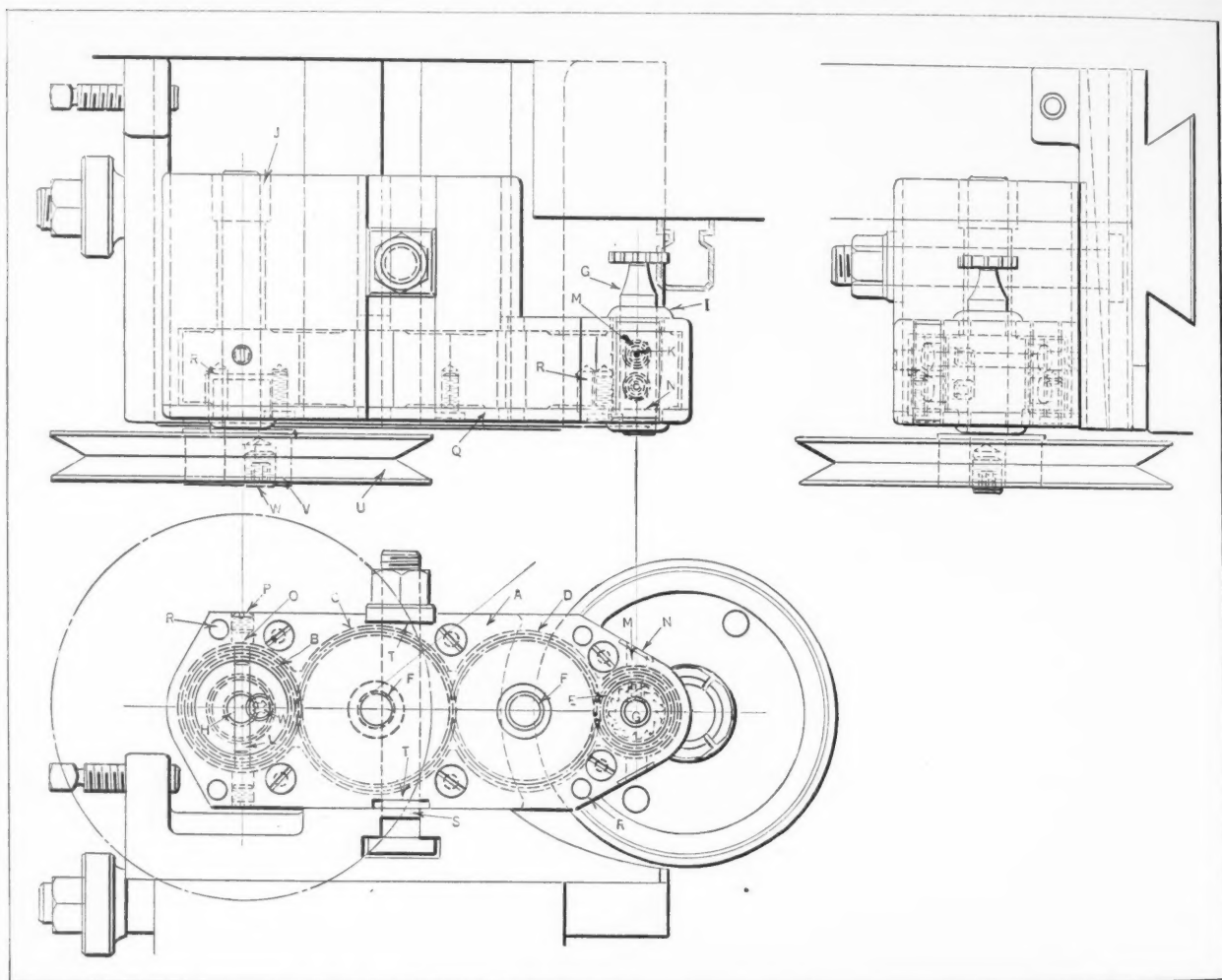
# CROSS-SLIDE MILLING ATTACHMENT FOR AUTOMATIC SCREW MACHINE

By HENRY SIMON

The cross-slide milling attachment here illustrated was designed for light work of small radius, 1 1/2 inches being the maximum cutter diameter ordinarily recommended, although very thin saws up to 2 inches in diameter could no doubt be used without trouble. It has the advantages of simplicity, comparatively low cost, quick adjustment within its range of work and the ability to work either close to or at a considerable distance from the chuck. It can be used equally well on either the front or the rear slide.

The gear assembly is held in place and aligned by a front plate *Q*, which is located by dowels *R*. The rear end of the body is shaped to give a generous seat on the cross-slide, and yet permit adjustment close up to the chuck. The attachment is located by a tongue *S* which may be used in either of the two grooves *T*.

It was found that a pulley *U* made of fiber gave a better grip than a cast-iron one. The fiber pulley is a force fit on the steel hub *V*, which is held to the driving shaft by a key-screw *W* threaded half into the shaft and half into the hub. It will be noted that the driving gear is bored out on the pulley side to make room for the longer bearing used for the drive spindle. All bearings are a force



Milling Attachment for Use on Cross-slide of Automatic Screw Machine

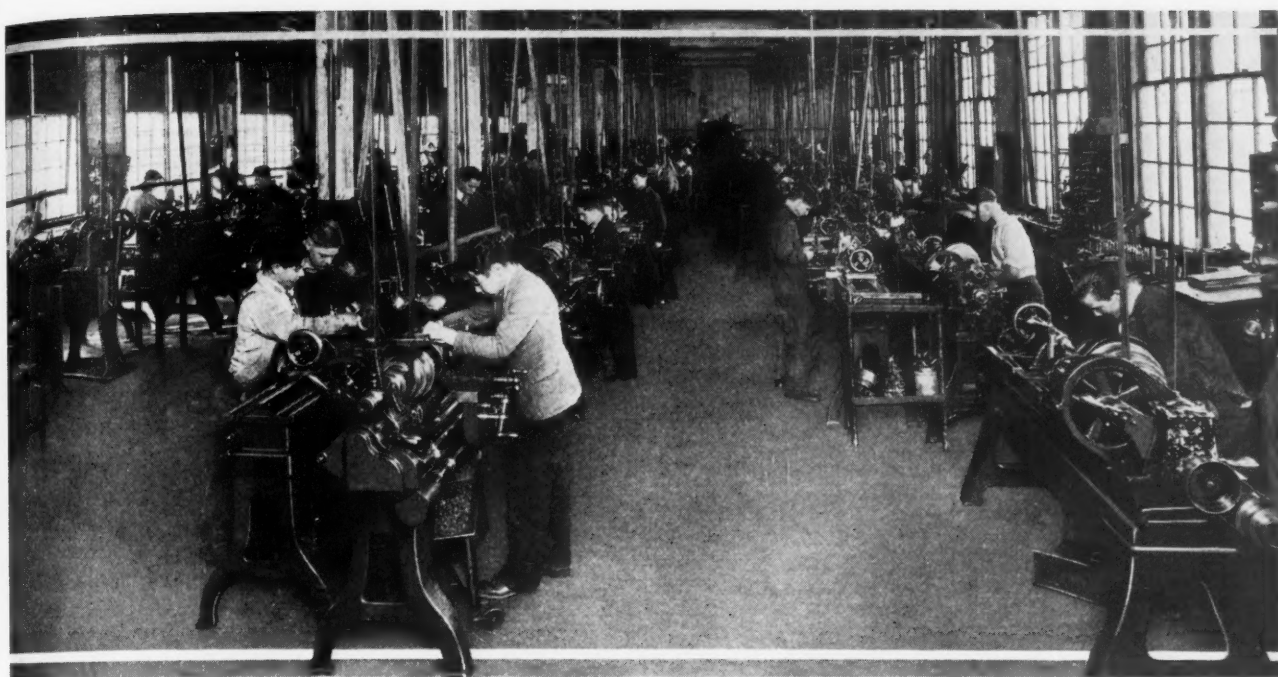
The tool has a steel body *A* of the general shape of a regular circular form tool holder. This body is bored out to receive a train of four spur gears *B*, *C*, *D* and *E*. The two center gears are idlers running on hardened pins *F*, while the shank of the Woodruff cutter gear *G* forms the shaft for the front gear, and the rear gear is mounted on the drive spindle *H*, both shafts revolving in bronze bearings *I* and *J*. The cutter is held in position by a pair of set-screws *K*, bearing on a flat in the shank, and the driving gear is fastened to its shaft by a cross-pin *L*. Holes *M*, closed by slides *N*, give access to the cutter-holding screws *K* for adjustment, and a pair of holes *O*, closed by screws *P* and serving also as oil-holes, allow cross-pin *L* to be knocked out without removing anything else.

fit in their respective seats, and are reamed to exact size after they are in place. The screws *K* should be a snug running fit in their seats, and they should have as wide a point as possible.

Though the original intention was to use the Woodruff cutters only, it will be clear that there is no reason why a regular arbor for receiving ordinary cutters should not be substituted. Such an arbor could be pinned right to the front gear, thereby doing away with the necessity of using screws. No trouble was experienced from the screws working loose.

\* \* \*

New Zealand with a population of slightly more than 1,400,000, imports annually from the United States goods valued at \$40,000,000.



## Training Boys in a Successful Trade School

By FREEMAN C. DUSTON

THE keen interest and justifiable pride that the boys take in their work at the Worcester Boys' Trade School, Worcester, Mass., is indicative of the success achieved by the directors and instructors in conducting the school along the practical lines originally planned by Milton Prince Higgins, founder of the school. The spirit of purposeful effort which exists throughout the school is in keeping with Mr. Higgins' "Philosophy of Learning a Trade" which appears on a bronze tablet in the main entrance hall of the school (Fig. 1). Another bronze tablet on the opposite wall of the entrance hall bears a bas-relief of Mr. Higgins with the inscription, "Milton Prince Higgins, Mechanic, Manufacturer, Educator, Father of the Public Trade School Movement in America."

For more than eighteen years the Worcester Boys' Trade School has been training boys for the industries of Worcester and nearby industrial centers. Thousands of boys have received instruction in many lines of trade since its first opening session on February 9, 1910. At the present time, boys are being trained in twelve trades as follows:

Machine shop practice; patternmaking; drafting; cabinet-making; carpentry; auto-mechanics; printing; plumbing; electrical work; brick masonry; sheet-metal work; and painting and wood-finishing.

Within the last four years extensive additions have been made to the school, which now has a total floor area of 113,300 square feet, including the

executive offices, library, reception rooms, assembly hall, gymnasium, and the twelve departments in which the shop training is carried on. Starting with fifty-two pupils in 1910, the membership has increased rapidly within the last few years until, at present, the attendance is more than 1000, with a large waiting list.

Each trade requires a period of four years for completion. At the termination of this period, if the work has proved satisfactory, a diploma is awarded. The student spends 4000 hours on shop work and the remainder of his school time in academic and correlated work. The shop work is carefully selected to give the exact grade of work required by the student for proper progress. The academic and correlated subjects are arranged to give the necessary training in the theory of the trades. This training not only prepares the boys to meet the demands of the trades, but also gives them a basic requirement for higher industrial duties, and is generally recognized and approved by the leaders of the many nationally known industries that are located in and about Worcester.

The shop work is conducted on a purely commercial basis. The student spends one week in the shop and the alternate week in the classroom. It has been found that this method produces the most rapid and thorough training for all the trades offered. The shop hours are from 8 A. M. to 5 P. M. daily, except Saturday and Sunday. The hours for class-

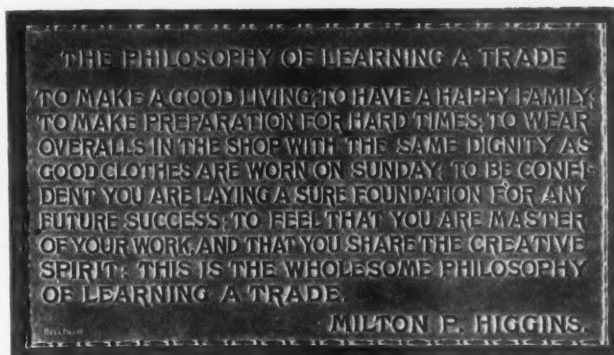


Fig. 1. The Founder of the Worcester Boys' Trade School Had a Sound Philosophy of Life and Work



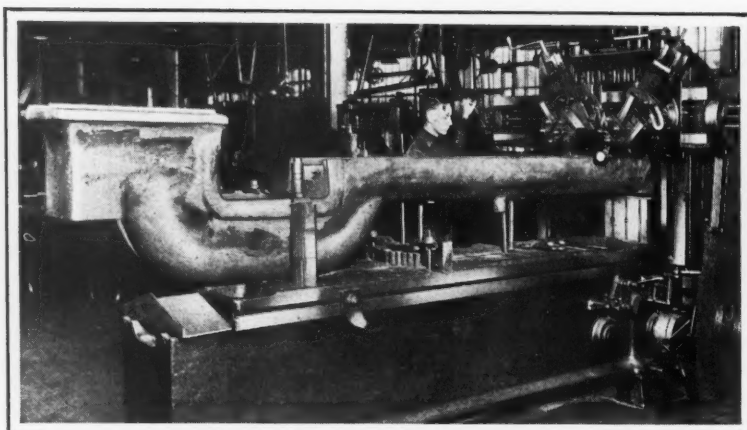


Fig. 2. Planer Work in Advanced Machine Department

room work are from 9 A. M. to 4 P. M. daily, except Saturday and Sunday, one hour being allowed at noon for lunch for both shop and classroom work.

The school year consists of forty-two weeks, and

period of six weeks, which offers students an opportunity to make up lost time. The summer school is also open to boys who wish to try out this line of education, with the idea of following it should they find it advisable to do so. The requirements for admission to the summer school are the same as those that have to be met for entering the regular day school.

## Admission Requirements

Boys fourteen years of age and over are eligible for admission to the day school. It is desirable that they be graduates of the grammar grades and show some aptitude along mechanical lines. Boys who have completed one or more high school generally make better progress in the trade school work.

There is no charge for tuition to students who live in the city. To day students who live outside

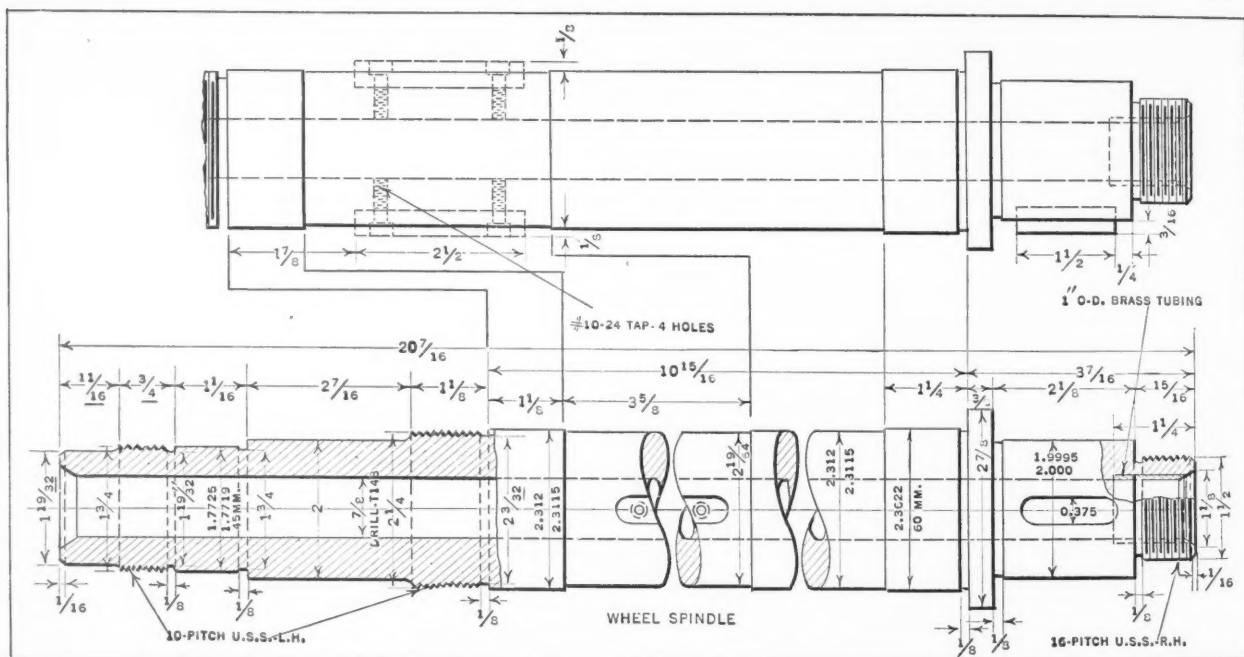


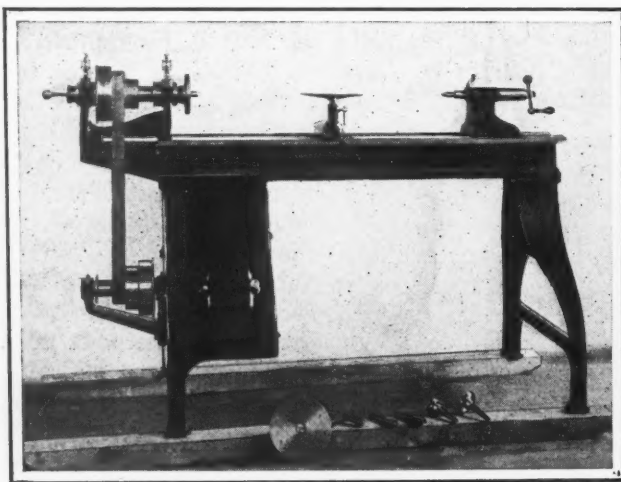
Fig. 3. Details of Spindle Finished by Boys in Advanced Grinding Class

is divided into three terms of fourteen weeks each. All legal holidays are observed. During the summer vacation, the summer school is conducted for a

the city but within the state there is a fixed charge of \$175 per year.

### Evening Classes for Men

The purpose of the evening classes at the Worcester Boys' Trade School is to give men extension training along the lines of their regular work or some allied trade. Many men already skilled in some branch of their trade look to this school for the means of acquiring skill in other departments which they could not obtain otherwise without considerable cost. A man, for example, may be a skilled lathe hand or a planer hand, but because he is not also competent as a milling machine hand, he may find it difficult to advance. Then, again, a man who is a skilled machinist often lacks the knowledge of mathematics or drawing necessary to fit him for the position of foreman or superintendent. The evening classes offer such men an opportunity to obtain that additional training that they need in order to advance more rapidly in their chosen life-work.



**Fig. 4. Patternmakers' Lathe Designed and Built at Boys' Trade School**

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the pattern room. The first-year boys are all under one instructor. The first term is devoted entirely to bench work, the boys being taught to use hand tools and read simple blueprints. The second term

includes simple lathe and band saw work, and in the third or last term of the year, jointer and bench saw work are included. The average boy makes about sixty small patterns during his first year's training. In making these patterns, the boys are required to work from detailed blueprints of parts like the one shown in Fig. 6.

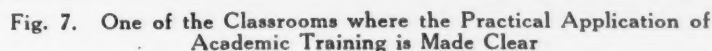
second year, in addition to making the regularly required, the boys are often in work for outside companies or in. This lends variety and teaches them



In Fig. 3 is shown the working details of a spindle produced for the makers of a well-known grinding machine. This particular product is typical of the class of work selected for the practice it gives in precision grinding methods. The various examples of work produced on the different machines are put through in quantity lots, the same as in machine-building plants. This enables the instructor to observe the manner in which the boys handle every detail of the work and to correct their errors.

Fig. 4 shows a 12-inch motor-driven pattern-room lathe designed and built at the school. This lathe has proved exceptionally well adapted for wood-turning in the pattern room, and several machines of this type have been made for manufacturing concerns.

In Fig. 5 is shown one section of





how to handle commercial work. The same procedure is followed in the third and fourth years, the class of work handled, of course, being of a more complicated nature.

Practically all the patterns required in producing machines or equipment for the school are made by the boys in the advanced classes. For instance, the patterns for the headstock, apron, tailstock, etc., of the gap-bed lathe, the bed of which is shown in Fig. 2, were made by the boys. Although the average boy learns to produce creditable patterns, the natural ability of some boys causes them to advance much faster than others. Such boys are allowed to advance as rapidly as they can. On the other hand, boys who find the work difficult or appear to lack interest in it are given every possible assistance in selecting some other trade for which they are better suited.

#### Classroom Instruction

During the regular alternate week sessions of classroom work, special instructions are given the boys in rooms adjacent to the shop departments. These instructions serve to tie up the regular classroom work with the practical shop work. In Fig. 7 is shown one of these classes at work. The same system of instruction is followed in all the twelve trades taught.

#### Training Facilities for Drafting Courses

The drafting department is fully equipped with all the necessary apparatus and materials, such as books, charts, models, electric blueprinting machine, etc., for the rapid and complete instruction of the boys. The room is excellently lighted, and provides the exact requirements for such a department. All materials, instruments, etc., are furnished by the school.

#### Social and Athletic Activities

Every Monday morning school work and shop work is stopped for one hour, and all the students gather in the assembly hall, where exercises are held consisting of singing, music, and addresses given by local or outside speakers on matters of current interest or on subjects relating to the various trades.

A school orchestra has been organized and contributes to the program of the morning assembly meetings and many other occasions. Pupils who are able to play acceptably on any instrument suitable for the orchestra are welcomed as members.

During the winter, private theatricals and dances with good music and under the proper supervision are often arranged by the students, subject to the approval of the director. A moving picture machine has been installed in the assembly hall, so that a wide variety of educational and entertaining films may be shown either during school hours or in the evening. A school paper called "Trade Winds" is published once a month. The copy for this is prepared by a board of editors chosen by the students, and the printing is done by the printing department.

The gymnasium is large and well equipped to give all students ample opportunity for physical development and recreation. A competent physical instructor is in constant attendance, and super-

intends a systematic course of physical exercise for all the students in the school, also acting as coach for the athletic teams. The major sports are football, baseball, basketball, and track events, and in all of these the Trade School has been able to hold its own with schools of similar standing.

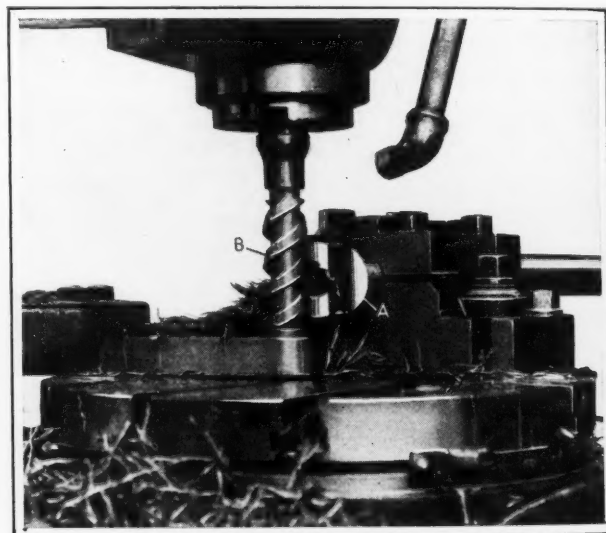
Parents and guardians of pupils, and all others interested, are cordially invited to visit and inspect the various departments of the school at any convenient time during working hours.

\* \* \*

### CIRCULAR FORM-MILLING ATTACHMENT

By HOWARD ROWLAND

The operation of milling form heads *A* on a long fork, as shown in the accompanying illustration, consists of taking one roughing and one finishing cut, 1/16 inch of stock being removed by the finishing cut. The fork is held in a jig on a standard circular milling attachment mounted on the table



Forming the Head of a Steel Fork

of a vertical milling machine. After locking the table against longitudinal movement, the cutter *B* is fed to the proper depth, using a power cross-feed.

The table is then unlocked and the left-hand traverse table feed employed for taking a cut of the correct length for forming one side. Next, the table is again locked and the rotary motion required for forming the radius of the fork is obtained by means of the circular milling attachment. After unlocking the table, the right-hand traverse feed of the table is employed to finish the other side of the fork to the proper length. This cycle of operations is exactly reversed in taking the finishing cuts.

The helical milling cutter *B* is 1 5/8 inches in diameter and has a special support at the lower end which extends out from the column of the machine. The cutter revolves at a speed of 128 revolutions per minute and removes 0.008 inch of stock per revolution. The machining time is approximately twelve minutes per piece. Flood lubrication is used to keep the cutter cool. A large reservoir in the base of the machine holds the supply of lubricant.

\* \* \*

A chain is no stronger than its weakest link, nor any machine better than the tools used in it.

# Oxy-acetylene Welding of Brass

By A. EYLES

**A**UTOGENOUS welding with the oxy-acetylene torch is an efficient and economical method of joining brass parts. The term brass includes the workable alloys of copper and zinc, with a range of copper content from 58 per cent upward. The large number of varieties of brass are designated by special names. A recently published list of alloys gives the names of nearly three hundred brasses.

From the viewpoint of the welder, commercial brasses fall into two distinct groups—those containing more than 63 per cent of copper, and those containing 58 to 63 per cent of copper. The former consist of homogeneous aggregates of crystals, while the latter consist of heterogeneous mixtures of two different types of crystal. A further useful division differentiates between those that are amenable to hot-working, and those that are not. Brass containing between 58 and 63 per cent of copper becomes plastic at high temperatures and can be readily forged. Brass alloys containing from 63 to 68 per cent of copper cannot be worked in the hot state, but above 68 per cent, plasticity at high temperatures again becomes a property of the alloys.

In a general sense, the color of brass is yellow, varying in shade according to the proportions of copper and zinc. It is harder than copper, and, according to the composition, has considerable tensile strength. Some alloys, like manganese bronze, or better manganese brass, have a tensile strength approaching that of steel. Brass forgings today can be made lighter than castings and still have greater tensile strength. Forgings have an average tensile strength of 50,000 pounds per square inch, as against 25,000 to 30,000 pounds per square inch for castings.

The melting point of brasses varies according to the percentages of the constituents; it is generally higher with a greater percentage of copper, the temperature closely approximating the mean melting temperature of the constituents. Thus while the mean melting temperature of copper is around 1085 degrees C. (1985 degrees F.), and of zinc, 420 degrees C. (788 degrees F.), the melting point of a naval brass consisting of 61.5 per cent copper, 37 per cent zinc, and 1.5 per cent tin is approximately 855 degrees C. (1570 degrees F.). The heat conductivity of brass is less than that of copper, and molten brass has great fluidity.

The melting of brass with the oxy-acetylene torch is accompanied by three distinct phenomena:

(1) Oxidation; (2) volatilization of the zinc; and (3) absorption of the gases. Oxides of copper may be formed; also there may be a loss of zinc by burning, which causes the white fumes of zinc oxide to appear; or there may be a loss of zinc due to the reduction of the oxide of copper by the zinc itself.

## Fluxes for Brass Welding

The fluxes commonly used in brass welding are of similar composition to those used in copper welding, namely sodium borate or a mixture of sodium borate (anhydrous) and boric acid, sometimes with the addition of sodium chloride or sodium nitrate to lower the melting point of the flux. Should any difficulty be experienced in purchasing the right kind of welding flux from manufacturers, borax alone may be used as a substitute (provided the surfaces are perfectly clean) with very good results; but before applying it, the water of crystallization should be driven off by the application of heat. The borax should then be reduced to a fine powder and applied to the surface to be welded as required. By preheating the borax and crushing it afterward, the subsequent foaming up of the borax on the weld joint is entirely obviated.

Traces of aluminum are often introduced into the flux or alloyed with the filling in material. This serves a twofold purpose—it prevents loss of zinc by volatilization and by the oxidation of the zinc, and acts as a deoxidizer; also the alumina formed protects the metal

from further oxidation and dissolving of gases. The amount of aluminum to be added is determined by the fact that the addition of 1 per cent of aluminum is equivalent to 3.5 per cent of zinc; in other words, the aluminum serves to prevent the loss of zinc and thus raises the zinc content in the resulting weld.

The most striking phenomenon in the melting of brass by the oxy-acetylene torch is the volatilization of the zinc. The vapors of zinc burn and are converted into the white fumes of oxide on coming in contact with the air. The fumes are unpleasant to breathe, and are injurious; as an antidote, the welder should drink a considerable quantity of milk.

## Welding Metal for Brass

The welding rod or filling-in material for brass welding should be manufactured from new metals, of the same composition approximately as the product to be welded. The zinc should be of good qual-

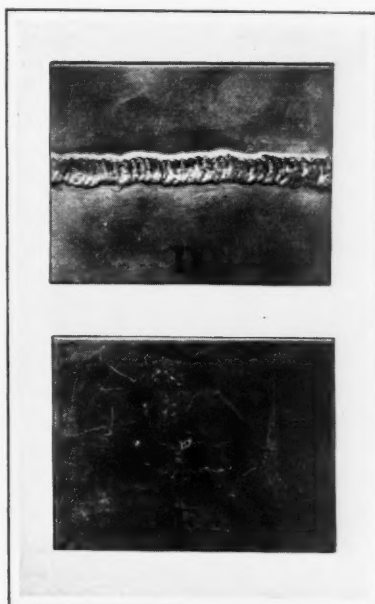


Fig. 1. (D) Butt Weld on 16-gage Brass; (E) Flange Weld on 20-gage Brass after Hammering and Polishing



ity to avoid incorporating into the metal impurities capable of facilitating the burning of the metal. A very small quantity of aluminum may be added to advantage after casting. As previously mentioned, this introduction of aluminum prevents the volatilization of the zinc, as well as oxidation, and dissolves the alumina. As the very small amount of aluminum present must be distributed throughout the metal, it is obvious that the manufacture of the welding rod is a very delicate process. It should, therefore, be in the hands of specialists.

Inasmuch as it is impracticable in ordinary repair work to determine the exact composition of brasses, it is obviously impossible to make a weld containing the same elements as the piece to be welded. In repair work, it is therefore desirable to find welding material that will apply to all the brasses likely to be handled, and suitable rods for general brass welding can usually be obtained from

In welding thin sections or sheets under 1/16 inch in thickness, the edges should be flanged as shown at A, Fig. 2, to an angle of 90 degrees and to a depth of one and a half times to twice the thickness of the metal, varying with the thickness. With this method, no welding wire or rod is used, since the flanges are fused down and provide the requisite filing metal for the weld joint. Before proceeding to make a long weld, it is advisable to tack the flanged pieces together by fusing the edges of the flanges at intervals of from 2 to 6 inches, depending on the thickness of the metal and the length of the flanged metal, before melting down the whole flange. This method holds the work in alignment and prevents movement at the end farthest from the point of welding.

One of the precautions in making flange welds is to secure complete penetration to the bottom (or to a sufficient depth to assure a good weld) and to

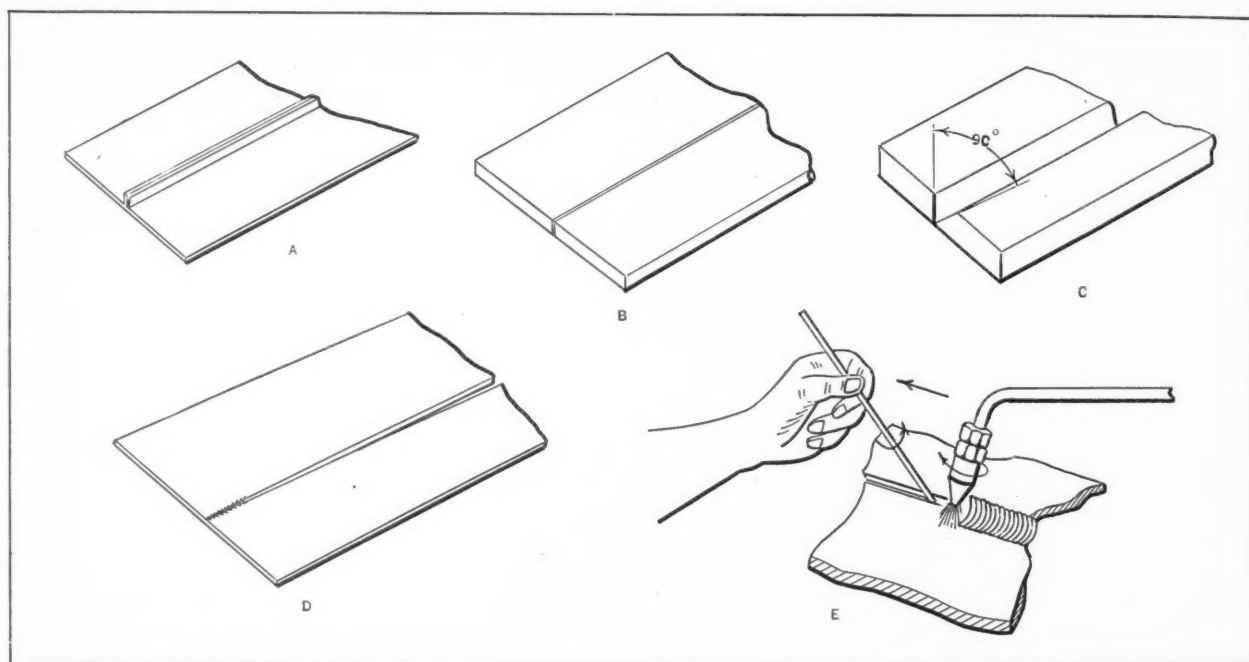


Fig. 2. Methods Used in Welding Brass of Different Thicknesses

manufacturers of welding equipment. The welding material selected should be in the form of drawn rods.

A good all-around welding material for brass castings and forgings is a manganese bronze alloy rod or wire containing a trace of phosphorus. For thin sheet brass sections, the welding material may be a strip cut from the same sheet, having a width of two or three times the thickness. Welding wire, strip or rod should be kept in a dry place, and should be carefully cleaned so as to be free from oxide, dirt, etc.

#### Preparing the Metal for Welding

The edges of the metal to be joined and the areas near the weld should be absolutely clean, as defective adhesion in brass welds is frequently due to neglect of this precaution. There are various methods of cleaning brass, including pickling (in nitric-sulphuric acid solutions), scraping, grinding, machining, sand-blasting, etc. The essential point is to remove, as perfectly as possible, all impurities from the immediate locality of the weld.

eliminate the oxide that is likely to exist between the flanged edges.

In order to overcome the excessive expansion and contraction and consequent warping of thin sections during welding, heat-conducting blocks or bars are employed. These blocks should preferably be of copper, and should be of substantial thickness, so that the heat which would otherwise expand and distort the brass may be readily absorbed.

In welding brass 1/16 to 1/8 inch thick, the edges may be simply butted together, as shown at B, Fig. 2. For metal between 1/8 and 3/8 inch thick, the edges should be beveled to an angle of 45 degrees, so as to obtain a vee having an angle of 90 degrees, as shown at C. The beveling should be methodically done, right to the bottom edges, so there will be penetration through the whole thickness.

In welding very heavy sections or castings more than 1/2 inch thick, where it is possible to weld from both sides, it is sometimes advisable to bevel the work in two stages, the angle of each open side being at least 90 degrees. This limits the width of

the molten bath to that required for half the thickness when using a single vee or triangular groove, and at the same time it counteracts the tendency to warp. Before beginning to weld heavy sections or large castings, it is advisable to preheat the work to be welded, taking care not to raise the temperature above 500 degrees C. (930 degrees F.). This preheating not only economizes in the consumption of acetylene and oxygen, but also enables the piece of work to be welded in less time, and a sounder job results than if welding is begun with cold metal.

At D, Fig. 2, is shown the method of diverging the edges on thin sections or sheets so as to prevent overlapping or spreading. The amount of divergence is dependent, to some extent, upon the thickness and composition of the brass, but it is safe to say that this divergence must not be more than 6 nor less than 1 1/2 per cent of the length of the weld. Some brass welders stick to the hard and fast rule of 1/4 inch per foot, which is a very satisfactory figure, in general. It is necessary to adjust the sections or sheets carefully and to retain them in their correct position; in production welding and repair work, various fixtures and jigs can be devised for this purpose. Jigs reduce the cost by increasing the speed of welding, and in production work, assure standardization in the products.

#### Procedure in Making Brass Welds

To successfully weld brass, it is essential to use the right size of torch tip for the thickness of metal to be welded. The welding tip should be larger than for welding steel of the same thickness. Experience shows that a powerful torch is necessary in welding brass, in order to shorten the welding time and allow of free fusion of the edges to be joined. A beginner will doubtless make holes in thin sections in this way, but with practice, the welder soon becomes proficient in the art, when using the correct size of torch tip. Tips one or two sizes larger than are customarily used on steel of equivalent thickness are recommended. A neutral flame is desirable in brass welding; in fact, good welds can be obtained only if the torch constantly maintains a neutral flame.

A torch must be used that is so designed and constructed that oxygen and acetylene will be delivered at constant pressure and in constant volumes. The proper point at which metal from the welding rod should be added to the weld joint is just after the heated metal is seen to boil and bubble at the surface. The operator must manipulate the torch flame in such a manner that the two beveled edges receive equal heat and become molten at the same time that molten metal from the welding rod is deposited in the welding groove. The diagram at E, Fig. 2, shows the method of making the weld.

It is especially important to avoid overheating of the metal, as the zinc content burns out at a comparatively low heat. Overheating is quickly revealed by dense white fumes, which are, as previously mentioned, injurious to the operator. When these white fumes rise excessively from the joint, the welder should reduce the heat, as it is an indication that zinc is being volatilized and the weld joint weakened. The tip of the white cone of the welding flame should be held 1/8 to 1/4 inch from

the molten metal, and the heat should be distributed over the area of the weld more than when welding steel.

During the welding operation, it is desirable to add to the weld joint a certain quantity of flux, and for this purpose it is best applied from the welding rod or strip. Dip the heated end of the rod or strip into the receptacle containing the powdered flux, when a small quantity adheres in the form of a tuft. The flux, when melted, covers the molten metal and protects it from oxidation. Although it is always advisable to use a good flux when welding brass, it may be worth while to state here that fairly satisfactory welds can often be obtained in brass without the use of a flux, especially if the welding is effected immediately after the surfaces of the metal have been properly cleaned.

#### Treatment after Welding

After the weld is completed, the work generally should be allowed to cool very slowly, especially in the case of complicated brass castings of thin section. Hammering the welded areas improves the mechanical properties of brass considerably. It should be done cold for brass containing 63 to 68 per cent of copper, and hot for brass containing 58 to 63 per cent of copper; in the latter case, care should be taken not to hammer the metal below a temperature of 500 degrees C. (930 degrees F.), because at this temperature, the metal becomes very brittle.

After hammering the welded areas, the metal should be annealed. For the majority of commercial brasses, a suitable annealing temperature lies in the region of 600 degrees C. (1112 degrees F.) and temperatures between this and 650 degrees C. (1202 degrees F.) adequately cover the annealing requirements of brass welds. Annealing at higher temperatures than these results not only in wastage of fuel, but also in heavy sealing losses and possible impairment of the physical properties of the weld joint and the rest of the metal.

Success in welding brass by oxy-acetylene methods depends largely on the intelligence and ability of the operator, as well as on the quality and kind of material employed. Sound welds possess a degree of strength only slightly below that of the original section, and by judicious reinforcing or building up, this can be increased, so that a strength equal to that of the original metal can be obtained. The welds or joints present a neat and finished appearance, are sound and homogeneous in structure, and from every standpoint, are of a very satisfactory character.

The oxy-acetylene welding process not only does the work of riveting, brazing, and soldering more economically, but it also produces a stronger and more finished product. Many mechanics confuse the modern art of welding brass with that of brazing the metal with the blow-torch and a filler rod of more or less heterogeneous metal. This should not be done, since the old-fashioned brazing process is entirely different, and readily distinguished from that of welding by oxy-acetylene methods. Brazing always lacks the continuity and uniformity of the mechanical properties of the joint that are so essential in making a sound, homogeneous, and strong union.



### LAPPING THIRTEEN CRANKSHAFT BEARINGS SIMULTANEOUSLY

The thirteen main and crankpin bearings of crankshafts used in the "Light-Six" automobiles built at the Racine, Wis., plant of the Nash Motors Co., are lapped simultaneously by the use of Bethel-Player machines of the type shown in the accompanying illustration. For this operation, the crankshaft is held between centers and driven by the headstock.

Before loading the machine, the operator carefully cleans it off with compressed air. After placing the crankshaft between the centers, he brushes each bearing with a lapping compound made of oil and abrasive. Then each lap, which comprises a split cast-iron bushing contained in a split holder, is brought forward and fastened on its respective crankshaft bearing. Opening and closing of the laps on the bearings is quickly accomplished by manipulating handles. In the operation, the lap halves function as one-piece laps. The laps on the crankpins, of course, move the same as cranks, while those on the main bearings remain in one position. While the lapping is in progress the crankshaft oscillates 1/4 inch lengthwise.

The crankshafts are lapped in from forty-five seconds to one minute, after which the finish of the bearings is observed before the work is removed from the machine. The tolerance on the diameters of the surfaces lapped is 0.0005 inch. The production averages eighteen finished crankshafts per hour. When the work is taken from the machines, it is immersed in kerosene to insure thorough cleansing.

\* \* \*

### DESIGN AND PRODUCTION OF GEARS

At the semi-annual meeting of the Society of Automotive Engineers held in Quebec June 26 to 29, two of the papers read, related to the design and production of gears. One covered "Ground Gears and Transmission Design" by H. F. L. Orcutt, managing director of the Gear Grinding Co., Ltd., Birmingham, England, and the other "Simultaneous Inspection and Correction of Gears in Production" by Charles H. Logue, consulting engineer, Syracuse, N. Y., and R. B. Fehr, director of the laboratory, Copland Gear Lapping Syndicate, Detroit, Mich.

Both of these papers contain much of interest to those engaged in the design and production of accurate gears. Copies may be obtained by addressing the Society of Automotive Engineers, 29 W. 39th St., New York City.

### BERYLLIUM MAY FIND INDUSTRIAL USE

The hardest of the light metals may soon be more commonly used than it has been in the past. Great progress has been made during the last five years in producing this metal commercially. In 1922, the cost of beryllium was at the rate of \$5000 per pound, but only a fraction of an ounce could be purchased, even at that price, because of the difficulties of obtaining it through any means then known to chemists or metallurgists. Today, the metal can be sold at \$50 a pound, and there are good prospects that in 1931, further developments may make it possible to market it in large quantities at a price perhaps as low as \$10 a pound.

What is there about beryllium to make it worth these endeavors to produce it at a cheaper price? It is its remarkable properties. It has but two-thirds the weight of aluminum, its specific gravity being less than 2. Yet it is so hard that it scratches glass easily, being one of the hardest of metals, and differing in this respect greatly from aluminum. It takes a high polish and remains untarnished in the air. Alloyed with aluminum, it adds strength and resistance to corrosion; alloyed with iron, it acts as a hardening agent; and its stiffening effect on copper is very great. To whatever metal it is added, beryllium seems invariably to transfer to it at least part of its own resistance to corrosion.

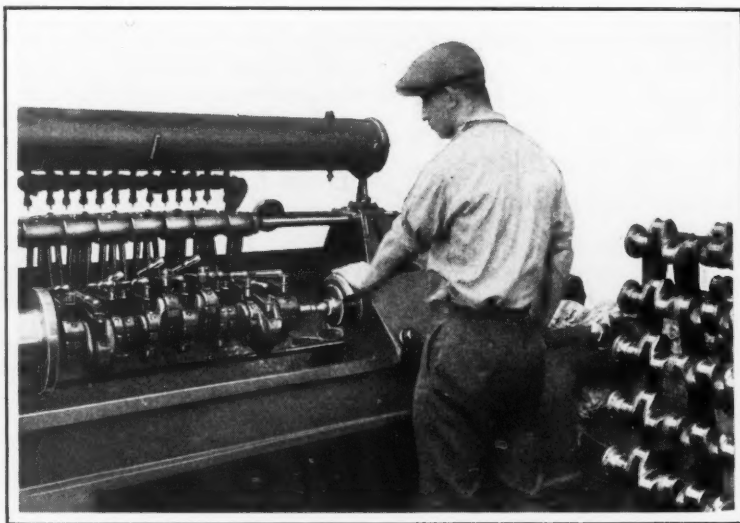
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### COMMERCIAL AVIATION IN THE WEST

A de luxe aerial passenger line has been established by the Western Air Express, Inc., between Los Angeles and San Francisco, Calif. The distance between the two cities—about 500 miles—is covered in from three to four hours. The fastest trains require about twelve hours for the journey. Three triple-motored monoplanes are used in the service, equipped with "Wasp" motors, each developing 425 horsepower, or a total of 1275 horsepower for the three motors. In test flights, the planes have developed a speed of 150 miles an hour, and a cruising speed of 120 miles. Any two motors will provide power to maintain the cruising speed, and any one motor will sustain the plane in flight. The planes carry twelve passengers, in seating arrangements as comfortable as in a modern Pullman parlor car. Stretching the full length of the cabin are windows that permit a complete view of the scenery.

\* \* \*

During 1927, Germany provided the leading foreign market for automobile replacement parts, buying from the United States to a value of \$6,445,000.



Simultaneously Lapping Six Crankpin Bearings and Seven Main Bearings of Automobile Crankshafts

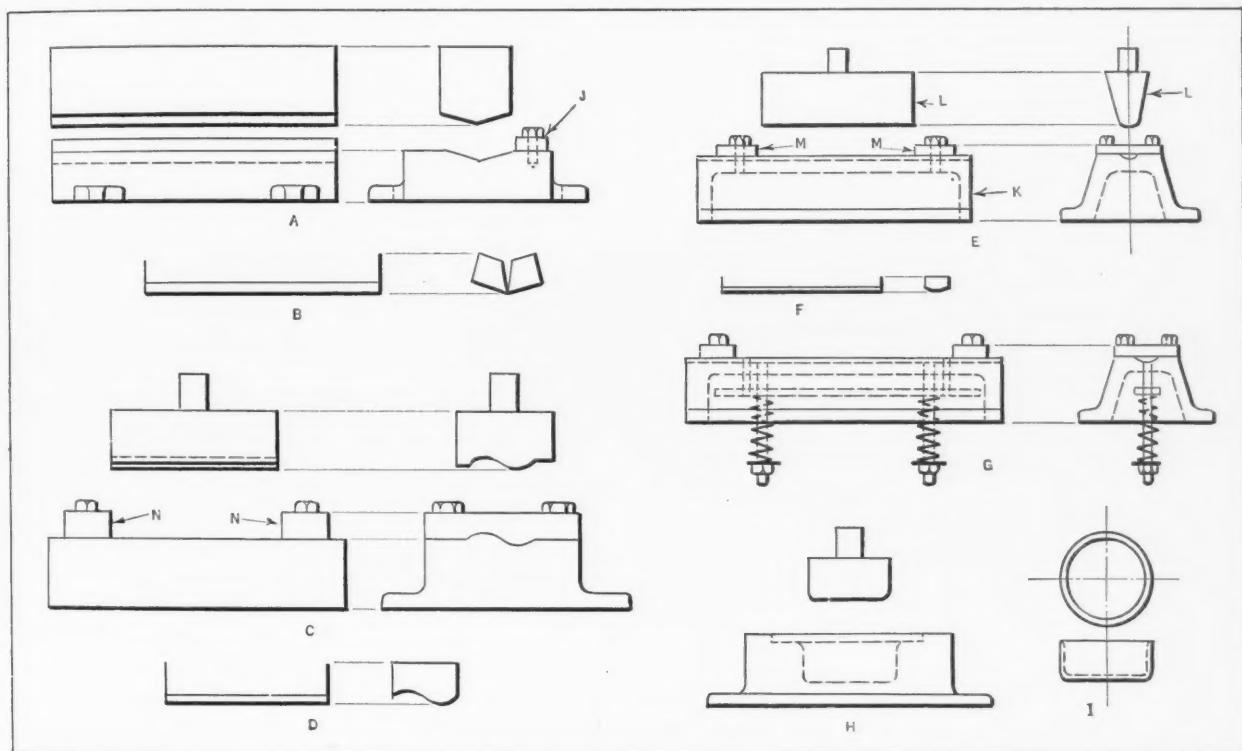
# Cast-iron Dies for Forming and Bending

By P. H. WHITE

**S**TEEL has long been recognized as the standard material for punch-press dies, and it probably will never be replaced. There are certain classes of work for which there is no practical substitute for steel dies. For example, no die designer would think of making a blanking die of any material other than tool steel or alloy steel which is capable of being hardened. The same is true of trimming dies or any others that must perform a shearing operation. Such dies must not only be capable of being hardened in order to resist wear, but must also possess toughness, which will enable

The principal advantage of cast-iron dies is the economy and speed with which they can be made. In some cases, where a high degree of accuracy is not required, the die need not be machined. For such a die, the pattern may be sent to the foundry one morning, and the die made ready for service the next. It might be possible, of course, to do this in some cases with a steel die, but obviously the cost of machining, as well as the cost of the material would be far in excess of that of the cast-iron die.

Such dies are of particular advantage on experimental work, where the exact size or form must be



Cast-iron Dies for Forming and Bending

the cutting edge to stand up under the shearing pressure.

Practically every complicated die is made of steel, even though it may not require high wear-resisting or pressure-resisting qualities. Ordinarily, steel can be machined as economically as any other suitable material, and its properties are often better known or at least more dependable than those of other materials that might be used.

There are some classes of dies, however, for which common cast iron is considered suitable by the tool designer and shop superintendent. This is especially true when the plant in question operates its own pattern shop and foundry. Dies of this class are suited for the simpler bending and forming operations, where the work is more in the nature of direct bending or compressing rather than a drawing action which may cause abrasion of the wearing surfaces.

determined by trial. This plan is sometimes used for drawing dies, in determining the size of the blank and the depth of draw that can be made at one operation, after which the permanent set of hardened dies is made up. A cast-iron drawing die will last for a considerable time if the pressure between the drawing surfaces is not excessive.

The accompanying illustration shows examples of cast-iron dies, some of which are in almost daily use. Those here shown, with one exception, are used in forming the blades for multi-blade fans. At A is shown a die for forming the break in the angular fan blade shown at B. The blanks are first sheared to width and length, and then notched at the ends to allow for flanging the ends at right angles to the blade. This die was finished on the bearing surfaces, and the stop or locating strip J was fastened to one side of the die for locating the blank.



The blade shown at *F* is curved to a 3-inch radius and the ends are flanged back at right angles in one operation, by the die shown at *E*, which consists of member *K*, the punch *L*, and the end-flanging blocks *M*. This die was cast from a wooden pattern, and placed directly in service without any machining whatever. At *G* is shown the same die with a spring-operated stripper added, for forcing the blade from the die.

At *D* is shown an "ogee" blade which is formed in the die *C*. This die is also used in the rough-cast condition without machining the forming surfaces. The principal wear on such a die is on the inner surfaces of the blocks *N* over which the flanges of the blades are drawn. By the occasional application of a lubricant to these surfaces, however, this wear will be so slight as to cause little trouble.

The die shown at *H* is used in forming the cup shown at *I*. It was necessary, of course, to machine this die in order to obtain the proper clearance between the punch and die. The stripper is not shown in the illustration. The examples given will convey some idea of the kind of work for which dies made from cast iron have proved successful. Many other products can, no doubt, be handled equally well on cast-iron dies of similar design.

\* \* \*

#### COUNTING PARTS BY WEIGHING THEM

In many shops, the method of counting stock parts approximately by weighing them on so-called counting scales or counting machines is extensively used. In an investigation recently made by the A. C. Nielsen Co., Chicago, Ill., at the plant of the Moline Implement Co., Moline, Ill., it was found that a National counting machine has been used in this plant for over twenty years.

As an example of the uses to which this machine is put, it may be mentioned that in one instance, malleable castings having considerable weight variations are counted in this manner, and in comparing the count obtained by weight with an actual numerical count, the error did not exceed 1.65 per cent. In another instance, parts running into a tonnage of from 100 to 120 tons a day showed an error of not more than 1.4 per cent, on yoke rings of considerable variation in weight. As a variation of 2 per cent is considered satisfactory for practical requirements, the accuracy obtained by this method of counting meets all needs in this plant. Compared with an actual numerical count of parts, it is estimated that one scale saves the labor of two men receiving approximately \$20 a week, the total saving being over \$2000 a year.

\* \* \*

A process for casting stone much in the same way as iron is cast has been devised, according to the *Scientific American*. The mixture consists of 1 part of cement to 3 1/2 parts of marble or granite aggregate—8 gallons of water being required per bag of cement. Three sizes of aggregates are employed, the largest screening through a 1/2-inch mesh. It is possible with this material, so it is claimed, to cast statuary having the outward appearance of carved stone.

#### HOW TO ORDER WIRE ROPE

By R. B. WILLIAMS, American Cable Company

Probably every wire rope manufacturer is repeatedly receiving orders which read something as follows: "Please ship us 242 feet of 5/8 inch improved plow steel rope," or "Ship by express 80 feet of 7/8 inch Seale." Such orders cannot be filled until further information is secured as to the type and kind of rope required; and when a user has an elevator stalled or a locomotive crane laid-up for want of a rope, the delay involved in obtaining more information is frequently very costly. Taking a few instances from my long experience regarding the proper method of ordering wire rope may save some reader a costly and aggravating delay when a rope may be needed in an emergency.

In ordering wire rope there are nine distinct points of information required. These are:

1. Length of rope.
2. Diameter of rope. (Before replacing an old rope it is always well to gage the sheave to ascertain whether it has been worn to an extent that will cause excessive abrasion or pinch the new rope. New sheaves are cheaper than wire rope.)
3. Numerical construction—the number of strands by the number of wires in each strand. For instance: 6 x 7, 7 x 9, 6 x 19, etc.
4. Type of construction—such as Seale, Spacer Seale, Guy, Warrington, etc. If in doubt of the exact construction, consult a qualified wire rope engineer.
5. Grade—whether plow steel, improved plow steel, etc.
6. Direction of lay—whether right or left.
7. Type of lay—whether Lang or regular.
8. Type of core—whether hemp center or independent wire rope center.
9. A full description of the class of service for which the rope is intended. Where more than one rope is used on a piece of equipment, specify which rope is required; as, for example, a boom rope or a hoist rope on a revolving shovel.

Where written properly, the order that originally might have read: "242 feet of 5/8 inch plow steel rope," would more correctly read: "242 feet, 5/8 inch, 6 x 19 Warrington, plow steel, left lay regular lay, with hem center. This is to be used for hoist line on derrick." If wire rope users will order their rope in accordance with these specifications, they will save themselves many costly delays and be assured of a more uniformly high average of rope service.

\* \* \*

#### FALL MEETING OF WELDING SOCIETY

The 1928 fall meeting of the American Welding Society will be held in Philadelphia, Pa., October 8 to 12, simultaneously with the Tenth National Metal Exposition and the convention of the American Society for Steel Treating. In conjunction with the Metal Exposition there will be an unusually large exhibition of welding appliances and equipment. The exhibition will be housed in the Commercial Museum, while the technical meetings will be held at the Bellevue-Stratford Hotel in the morning and at the exhibition hall in the afternoon of each day.

# Work-supporting Pins for Fixtures

By ALFRED M. WASBAUER

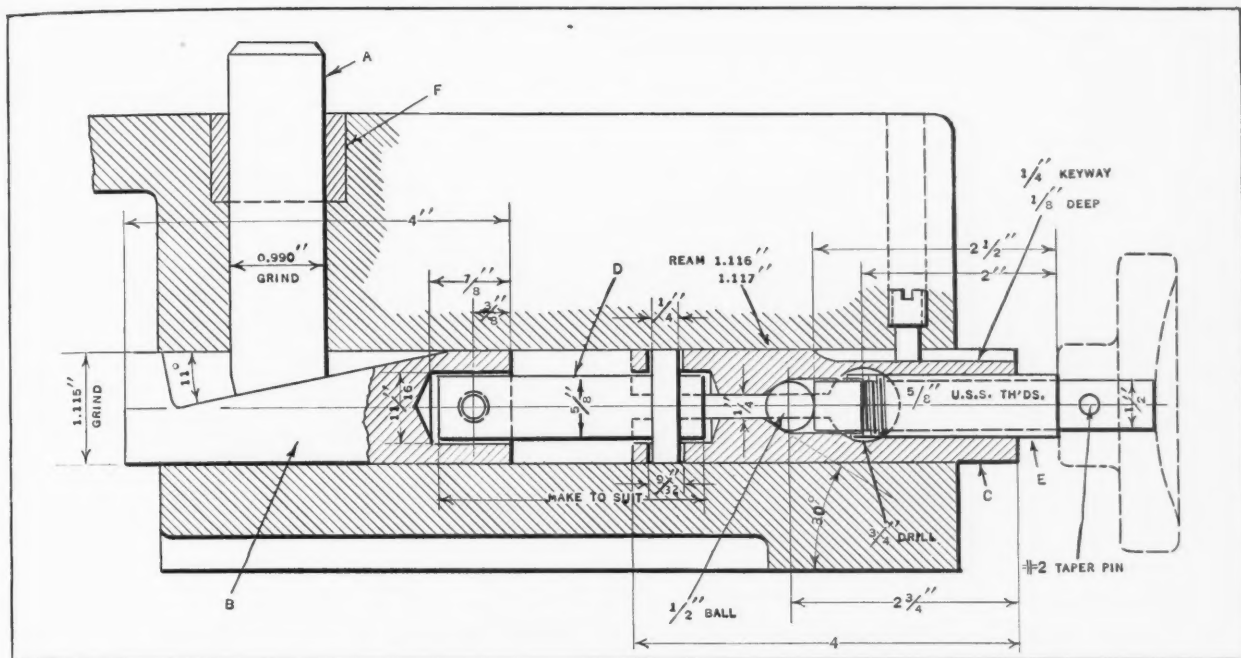


Fig. 1. Adjustable Work-supporting Pin and Locking Screw

**A**DJUSTABLE or hand-set rest pins for supporting rough or uneven castings are an important detail of fixture design. Rest pins of the type shown in the illustrations have been used extensively, and have proved so satisfactory that the writer recommends their use wherever castings require support at more than three fixed points.

The pins must be brought into their supporting positions before the work is clamped in place, since they are intended to prevent distortion due to the pressure of clamping as well as the pressure of the cutting tools. For this reason, they must be so designed that they can be set by the sense of touch. If such sensitive adjustment were not necessary, ordinary jack-screws could be used in many cases.

With a coarse-thread jack-screw, or where the work is quite heavy, it is difficult to determine by the sense

of touch, the exact point at which the jack-screw makes contact with the work. Even if it were possible to use jack-screws generally for supporting such work, they would have to be locked in position when once set, as the vibrations set up in the work by the machining process would probably cause them to back away. For these reasons, hand-set rest pins, operated by a wedge which can be quickly locked in position when contact with the work is felt, are in general use.

Fig. 1 shows the conventional type of hand-set rest pin, which consists of a rest pin A for supporting the work, a wedge B for actuating the rest pin, a wedge lock C for locking the wedge in position after setting, and a link rod D of suitable length, connecting the wedge and wedge lock. The link rod is made with a loose connection to both wedge and wedge lock in order to allow the wedge to present itself squarely to

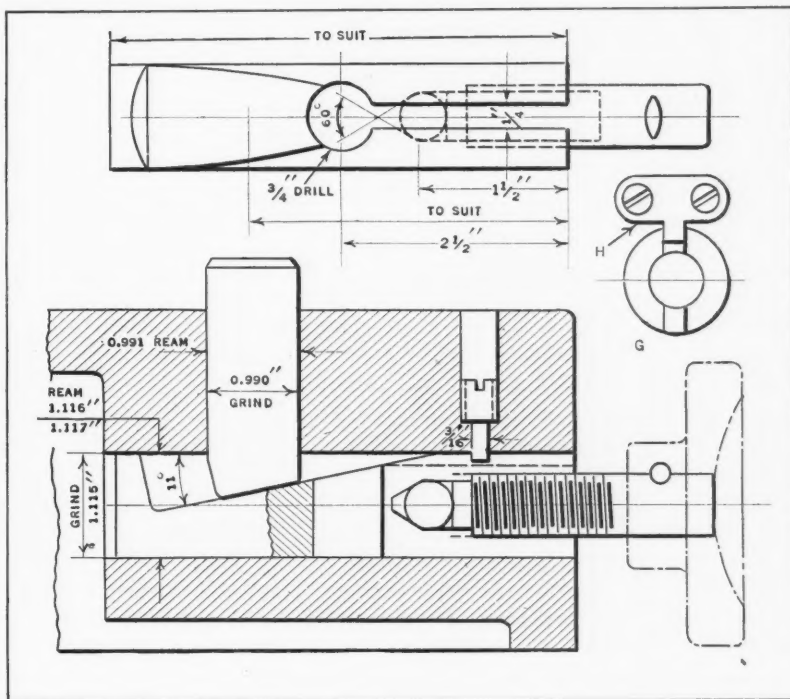


Fig. 2. Type of Work-supporting Pin Used Near Edge of Fixture



the rest pin, regardless of any slight rotative movement imparted to the wedge lock by the screw *E*.

When production is heavy and continuous, it is well to confine the rest pin within a hardened and ground steel bushing *F* at the top of the fixture. The need for a bushing at this point is determined by the severity of the service expected of the fixture and the length of bearing of the rest pin in the fixture casting. When the rest pin is very short, a steel bushing is advisable.

In Fig. 1 are given dimensions and specifications that have been found satisfactory in practice, particularly in machining castings such as cylinder blocks, cylinder heads, crankcases, etc. A considerable saving is effected by making the rest pin and the wedge of cold-rolled steel, using an old reamer ground down to the proper dimension for reaming out the holes in the fixture casting.

The rest pin can be made of 1-inch cold-rolled steel, machined on the ends, carburized, hardened and ground in a centerless grinder to 0.990 inch in diameter. The wedge can be made of 1 1/8-inch cold-rolled steel and handled in the same way. If no centerless grinder is available, the blanks should be chucked and centered accurately. The wedge lock can also be made of the same material, although some provision must be made to prevent extreme distortion in hardening and also to center the piece for grinding.

Fig. 2 shows a cheaper but equally satisfactory design intended for use where the rest pin is located close to one side of the fixture. Owing to the difficulty of locating the confining screw hole accurately in the center of the wedge slot, the end of the screw is made 1/16 inch smaller than the slot in the wedge to allow the wedge to square itself under the rest pin. At *G* is shown another method of confining the wedge, in which a key *H* fastened to the face of the fixture casting engages the slot in the wedge.

\* \* \*

## MACHINING ACCURATE LIGHT-WEIGHT FACEPLATE

By DONALD A. HAMPSON

The improved method of turning light-weight faceplates shown in the accompanying illustration was adopted in order to secure a true surface and eliminate chatter marks. It is often necessary to take light finishing or truing cuts of this nature on important surfaces after assemblies have been made. In this case, the 14-inch cast-iron faceplate *A* of light section is screwed tightly against a shoulder on its spindle which also serves as the pinion for driving the plate when it is in actual use.

In finishing the first faceplates of this type, a light cut was taken over the face and periphery of the plate while the spindle was held between the centers of a lathe. A great deal of time was lost

in securing cuts without chatter, and it was impossible to obtain a surface that would gage closer than 0.002 inch when the spindle was revolved in its own bearing.

Having exhausted the possibilities of lathe-center turning, the plan of supporting the faceplate in an equivalent of its own bearing for the finish facing and turning was tried out. This method, employing the set-up shown, has proved very successful. An A-shaped casting *B*, with sides of 1/2- by 4-inch cross-section and a reinforced base, was made and machined to fit the shears of the lathe. A 1-inch hole was reamed in line with the centers and a saw cut taken through the upper side of the bearing thus formed, binder screws being provided for adjustment. The A-shaped casting is bolted to the lathe ways the same as a steadyrest.

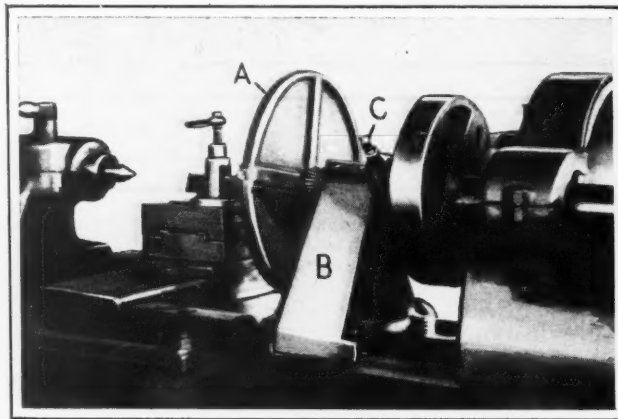
The assembled parts are driven by a dog *C* on the inner and projecting end of the spindle of the work. The binder screws are adjusted to give as close a running bearing as possible without danger of scoring the well lubricated surfaces. With this equipment, facing cuts are made at speeds which

were previously impossible, and tools having a greater contact area are used. This has greatly improved the quality of the finish. A single cut now produces an acceptable face, whereas several cuts were often required when the work was held on centers. The faceplates finished by the new method run as true when the assembly is placed in its own bearing as when set up in the machine and fixture.

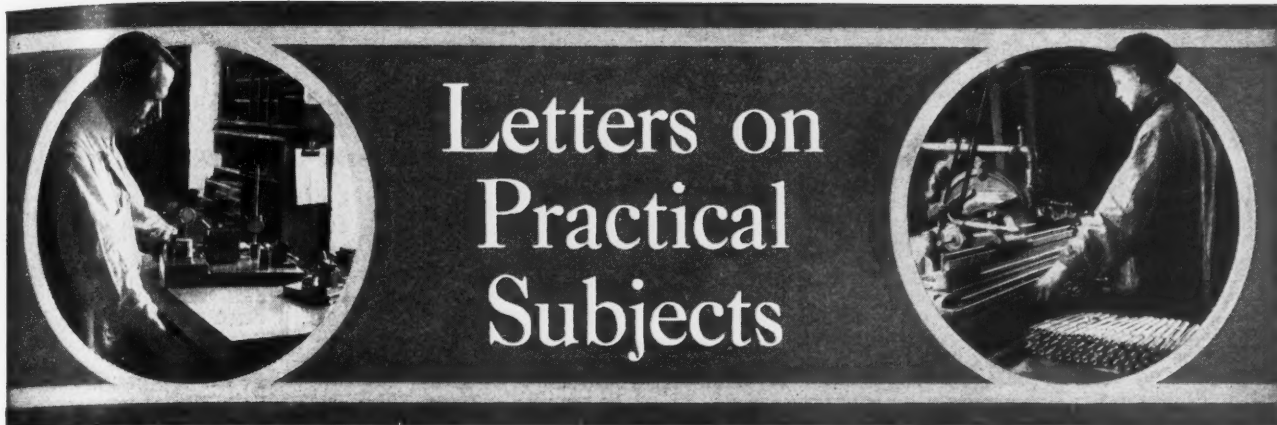
The plan of machining faces of parts while they are running in their own seats or bearings is not new, nor is the use of a fixture to simulate this, but the advantage of using such fixtures is not always realized in small-lot work. In this case, not over six units were finished at a time, yet the cost of the fixture was saved in machining a single lot. The centers of a good lathe did not offer the bearing surface and rigidity afforded by the fixture, and the accuracy of the work suffered in consequence.

\* \* \*

Next to the United States, Great Britain is the world's largest producer and consumer of motor vehicles. British makers, according to the Department of Commerce, produce approximately 200,000 passenger cars and trucks each year, having a value close to \$300,000,000. Approximately \$100,000,000 is invested in the passenger car manufacturing industry. The automotive industry, taken as a whole, ranks first among the British engineering industries. The Department of Commerce has issued, as booklet No. 63 in its Trade Promotion series, a treatise entitled "Automotive Industry and Trade in Great Britain and Ireland." This bulletin may be obtained by sending fifteen cents to the Superintendent of Documents, Washington, D. C.



Lathe Equipped for Machining Light-weight Faceplate



# Letters on Practical Subjects

## ASSEMBLING AND FINISHING BRASS CASTINGS ON THE TURRET LATHE

The job described in this article consists of assembling by rolling two brass castings of the main casing of a hydraulic device. A one-piece casting was formerly used but castings of this shape could not be satisfactorily produced on the molding machines. It was essential that the joint be watertight, and the counterbores had to be concentric with the center hole (see Fig. 1).

The work was accomplished satisfactorily in production quantities on a turret lathe by employing the rolling heads mounted on one face of the turret (Fig. 2), and an end cutting form tool mounted on another face of the turret, as shown in Fig. 3. Base casting B, Fig. 1, was held in the chuck of the turret lathe, and the shoulder at E

the bore E of which was previously machined and counterbores C and D roughed, was then pressed over the shoulder by means of a push-block held in one station of the turret. The rolling heads were next brought into contact with the projection of the shoulder E, forcing it down against the bottom of the casting A and thus making a watertight connection.

The rolling head, Fig. 2, is made of two revolving tools A having deep serrations cut on the angular face B. The serrations are cut so that the outer edges are sharp and knick into the soft casting, leaving a neat appearance on the rolled surface. These tools are a running fit in hardened and ground bushings C, and at the bottom of the bore of these bushings are placed thrust ball bearings D. Tool A is prevented from working out of bushing C by pins E, which fit into a groove in the shank of the tools, as shown in section a-a.

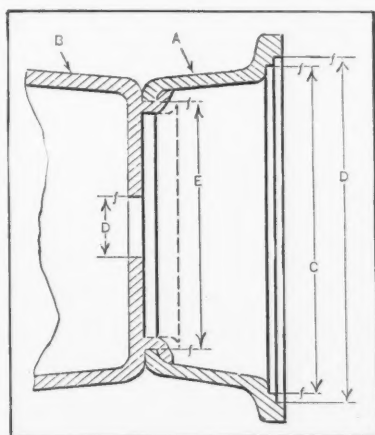


Fig. 1. Parts Assembled by Device Shown in Fig. 2

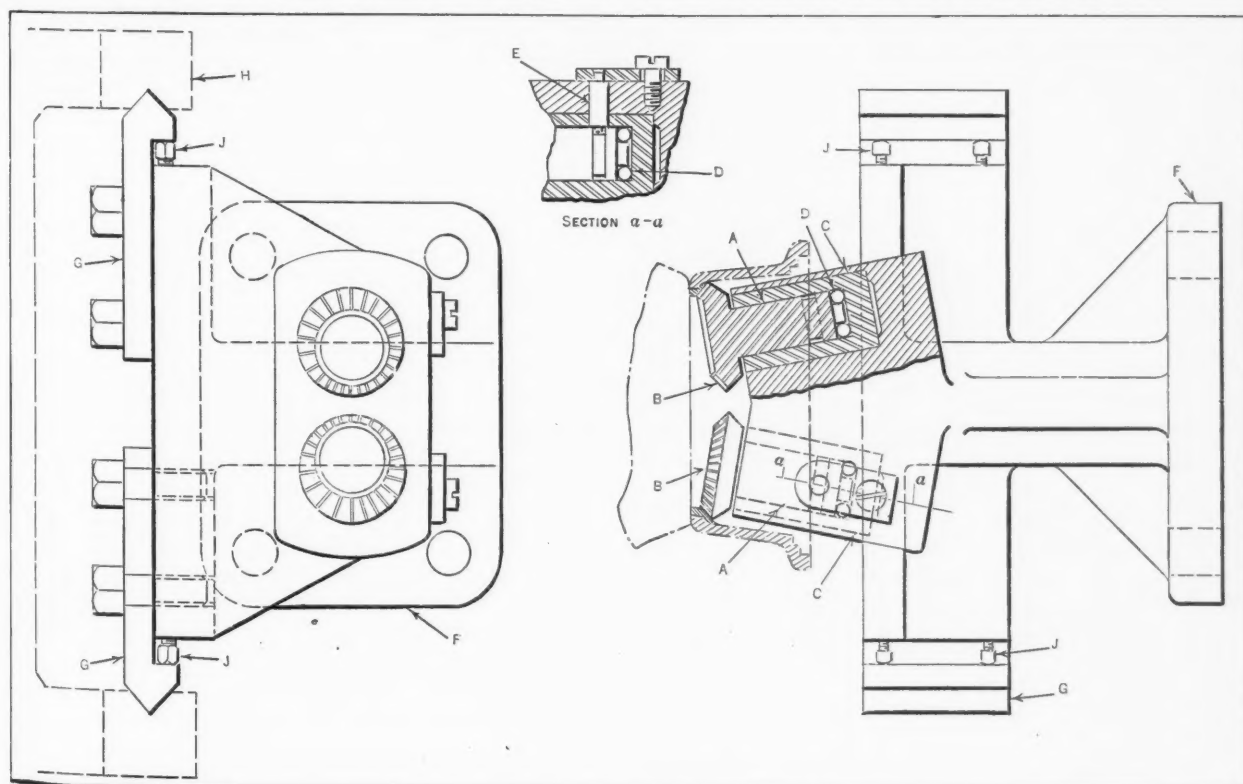


Fig. 2. Rolling Tool Mounted in Turret Lathe



The bushings *C* are a force fit in the bracket *F*, being located at an angle of 10 degrees with the vertical center line. Bracket *F* is bolted to one of the stations of the turret. At the bottom of the bracket, adjustable V-shaped slides *G* are bolted. These are so placed that they will slide in steadyrest *H*, so as to hold the tools rigid during the operation. Adjusting screws *J* are used to insure proper fit of the slides in the steadyrest vees.

The finishing of the two counterbores is a rather unusual application of an end cutting tool (see Fig. 3), which is formed throughout its length on one side, so that it can be sharpened by grinding on the end without changing its original form. The cutting edge of the tools is located tangent to the bottom of the work. In order to get the straight form tool *A* inside the casting to finish the two seats or counterbores without interference or

described in connection with the previous operation.

New York City

B. J. STERN

### CORES AND BOSSES FOR SMALL-LOT WORK

One of the common practices in patternmaking is to put on core-prints wherever there are holes of medium or large size to be made in the casting. There is no standard practice for this; some shops core all holes over 1 inch in diameter, while others core holes as small as 3/4 inch, and still others even smaller. In some cases, the designer specifies which holes are to be cored; in others, this is left to the judgment of the patternmaker.

The principal reason for using cores in castings is to save on the cost of the metal and on the labor in the shop. Another reason is to insure sound

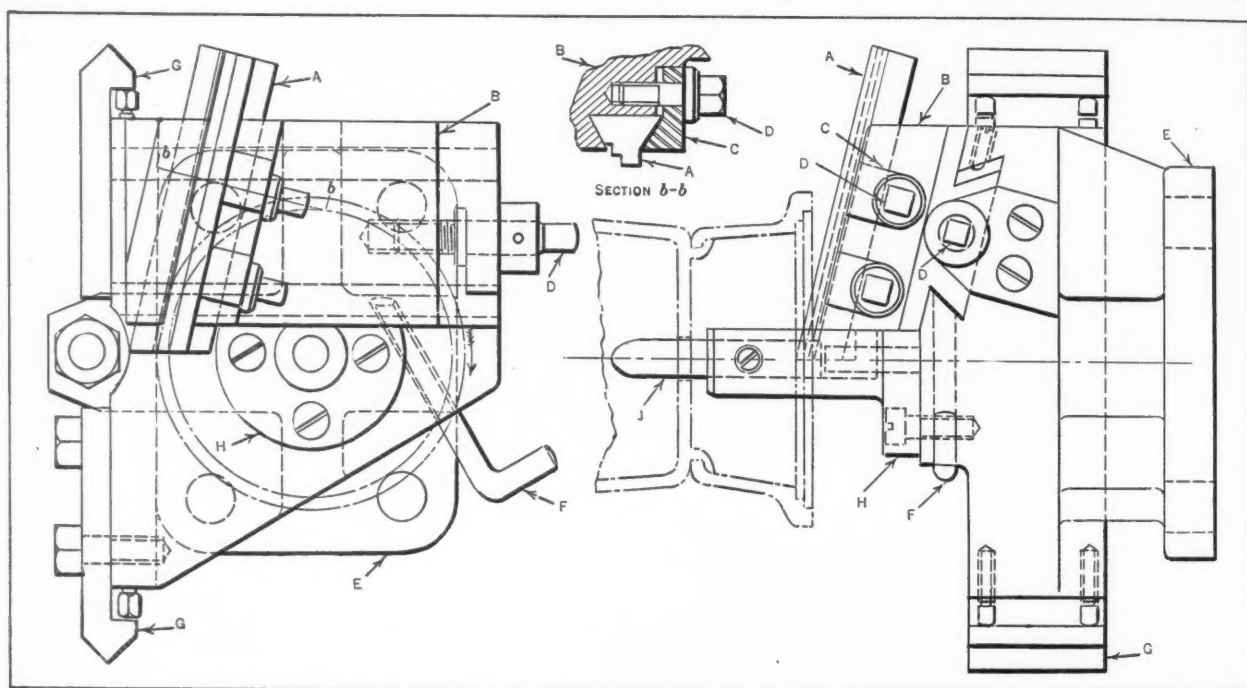


Fig. 3. Finish Counter-boring Work Shown in Fig. 1, with End Cutting Form Tool

scraping, it is placed at an angle of 15 degrees with the horizontal as well as 15 degrees with the vertical.

The cutting edge of this tool is so ground and set as to coincide with the vertical and horizontal planes at the center of the work. The sides of cutter *A* are machined at a 30-degree angle and fit a corresponding angle in the tool carriage *B*. Two clamps *C* which fit the side of tool *A* are located in grooves cut in the side of the tool carriage and clamp down on the tool. The tool carriage *B* is dovetailed and gibbed in bracket *E*, and is vertically adjustable by means of screw *D*. A bent stud *F* is used to clamp the carriage when it has once been set. The bracket *E* is bolted to a turret station.

Bolted to a finished pad in the center of bracket *E* is a sleeve *H* which carries a hardened and ground pilot pin *J* secured by a set-screw. This pilot fits the previously reamed hole in the base casting, accurately locating the tool for its cut. To insure rigidity during this operation, adjustable guides *G* are clamped to the bottom of the bracket *E*, fitting the vees of the steadyrest, as

metal in a thickened section of the casting. The latter reason is an important one, both in job work and manufacturing, but it is quite likely to be considered secondary to that of costs.

There exists in some quarters a mistaken idea that cores save money in all cases. Generally, where only a few castings are required, and the holes are under 1 1/2 inches in diameter, cores really add to the expense of the castings, for the metal saved does not compensate for the increased pattern, foundry, and machine shop costs. Relatively small holes may be drilled faster and better from the solid than when following a cored hole. Three- and four-lip core drills are the only ones that successfully drill slightly off-center cored holes, and they are seldom available for odd jobs. It takes considerable time to make an ordinary two-lip twist drill follow a circle scribed around a cored hole, and it takes a lay-out man longer to scribe the required lines when he has a broken surface to work on. There is a rapid depreciation in two-lip twist drills in this service, because the lands wear away fast when there is no metal to support the cutting edge. A dull drill also consumes vastly more power.

An interesting practice was observed in a shop that does experimental and contract work, to guard against the unsightly appearance of holes drilled off the center of bosses on such parts as arms, levers, frames, etc. Such offsets may be due either to slight changes in center distances or to casting inaccuracies, and often indicate insufficient strength and lack of foresight. The plan of this experimental shop is to use elongated bosses. Holes drilled in these do not have the appearance of botched work. In this way parts are saved that would otherwise be scrapped.

It is common practice in this shop to leave the travel of some part to be adjusted by the changed center distance of an arm, or to leave the final hook-up to be scribed on a link whose length cannot previously be determined closer than  $1/8$  inch each side of the calculated center. When assembled, this end of the link is put at the lesser visible point.

Middletown, N. Y.

DONALD A. HAMPSON

eight and twelve teeth, etc., with no resetting of the work. The edge of the table is also divided into degrees for use in setting the table for milling straight across and for general work.

Extension *F* of the latch bracket serves as the index finger for angular settings. By modifying the design of the latch-pin and its control, positive stops could also be provided for five-tooth and other special indexing. The work-table is held down on the base of the attachment by the through bolt *G*, against which spring *H* operates through the plate *K* and the castle nut and washer. The upper castle nut locks the bolt to the work-table, so that the two rotate together.

In the center of the work-table is a shallow counterbore in which a wooden plug *W* is fitted, which serves to protect the head of the through bolt. The spring *H* is retained in its cage by ring *L* which, in turn, is fastened to the base by screws *S*. This construction permits the work-table to be easily re-

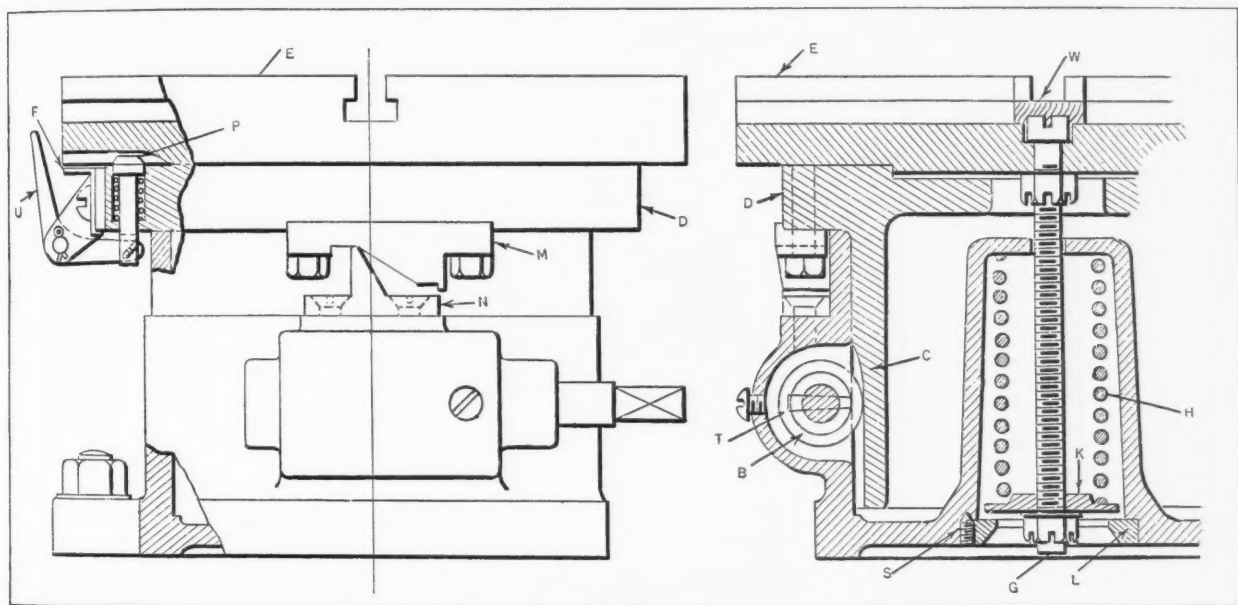


Fig. 1. Clutch Milling Attachment

### CLUTCH MILLING ATTACHMENT

Milling operations on clutches of the claw-tooth type are greatly simplified by the use of the special attachment shown in the accompanying illustrations. Incidentally, the general design of this attachment makes it suitable for a wide range of work. It is intended for rapid production by semi-skilled labor when used on a milling machine in conjunction with cutters of the form shown diagrammatically at *R*, Fig. 2. For clutches of this kind, the flat portion at the bottom of the tooth is gashed out by separate cutters. The cutters are located with their axes in line with the center of the clutch tooth faces, the slight concavity thus produced being trimmed off by a later hand operation.

Rotation of the crank-handle *A* causes worm *B* to rotate the worm-wheel *C* and the top plate *D*, Fig. 1, integral with it. Mounted on plate *D* and rotated by it through latch-pin *P* is the work-table *E*. This work-table has twenty-four equally spaced indexing slots or keyways on its lower side. The indexing slots enable gashing or plain dog tooth cutting to be done on clutches with two, four, six,

moved and replaced by a table of different form. The spring mounting enables vertical motion of the work-table to be obtained simultaneously with the rotating movement.

For claw-tooth clutches and similar work, a forming block such as shown at *M* attached to the under side of plate *D*. These blocks are designed to produce the required ratio of lift to rotation by making contact with the stationary tracer finger *N*, which is attached to the base. Several tapped holes are provided in plate *D* to accommodate forming blocks of different sizes. After each tooth is cut, plate *D* is returned to the starting point by reversing the hand-crank rotation, and the work-table *E* is indexed ready for the next cut. The maximum depth of tooth which can be cut is  $3/4$  inch.

When assembling the attachment, the worm is held in place from inside the base, while the shaft is passed through the bearings and the worm. The taper pin *T* couples the worm to the shaft. A hole in the worm casing allows the taper pin to be inserted and secured in place by riveting over the small end. Lubrication of the worm is provided



for by the oil well formed at the bottom of the base casting.

Slotted lugs on the base enable it to be clamped to the milling machine table. T-slots in the table *E* permit work to be clamped down or a chuck to be secured in place, the center hole over the wooden plug serving to centralize the chuck.

The latch-pin *T* is operated by the trigger *U*. When pressed inward, trigger *U* serves to withdraw the latch-pin from the indexing slot. The fact that the latch-pin assumes different positions

with the holes in the index-plate. The holes in the index-plate should be about 1/8 inch in diameter. An index-pin having a pointed end which is a good fit in the index-plate holes and a shank which fits the holes in the bracket, is required. This index-pin serves to hold the cone pulley firmly in position.

In the socket that ordinarily holds the T-rest is fitted the shank of a small table, about 6 inches square, which is adjustable up or down to suit the work. Let us assume, for example, that a hexagon-shaped pattern is to be formed. In this case, the table is set so that its height above the center of the lathe spindle is the same as the distance from the center of the hexagon pattern to one of the flats. The index-pin is then placed in hole No. 16 of the 96-hole circle. Next, the side of the paring chisel is laid flat on the table, and the first flat on the pattern cut to the proper depth, using the table as a height gage and guide for the chisel. The indexing pin is then withdrawn, the cone pulley turned to the next position, and the pin inserted in hole No. 32, and the second flat cut. This procedure is repeated until all the flats are formed.

In shops where no disk sanding wheel is available, the table described can be used to advantage in connection with a plain light-weight faceplate having a sandpaper surface. The plate should have a diameter equal to the width of a regular sheet of sandpaper. The faceplate should not be given a smooth finish, as the glue used to secure the sandpaper in place will have a better hold on a rough surface. When the sandpaper becomes gummed up, it may be cleaned with a nail brush saturated with alcohol. The worn-out sandpaper can be easily removed if allowed to soak for a time in water.

Carmel, N. Y.

F. LEU

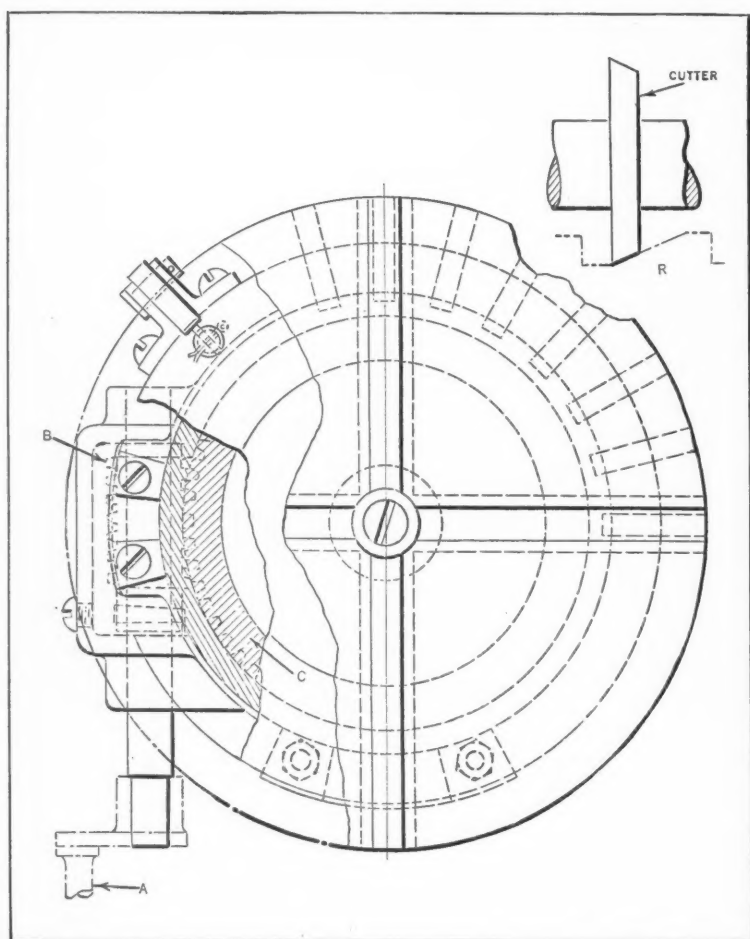


Fig. 2. Plan View of Clutch Milling Attachment

relative to the feed-handle, according to the length of the former block that is in use, causes practically no inconvenience.

Auburn, N. Y.

W. S. BROWN

#### INDEX-PLATE FOR PATTERMAKER'S LATHE

Accurate spacing around a cylindrical pattern can be easily done on a lathe provided with a simple index-plate. The index-plate should be fitted in a recess machined in the face of the large end of the cone pulley. Two rows of holes spaced on concentric circles on the index-plate provide for almost any spacing requirements of the patternmaker. There should be ninety-six evenly spaced holes in one circle and ninety holes in the other. The holes should be numbered from 1 to 96 and from 1 to 90, respectively.

A small bracket having a lug which projects past or over the holes in the index-plate should be attached to the lathe head. This bracket should have two 3 1/4-inch holes which are accurately aligned

#### FIXTURE FOR PLANING RADIUS IN LOCOMOTIVE DRIVING-BOXES

Machining the radius for the crown brass fits in locomotive driving-boxes is usually done on a slotter or a draw-cut shaper. In some cases, the work can be handled on a planer by using a special radius planing tool like the one shown in the illustration. This tool is bolted directly to the saddle on the cross-rail of the planer. The clapper-box is removed, and the large steel base *H* of the tool secured in its place.

The regular feed is utilized to rotate the tool-block after each stroke of the table, as shown in the illustration. The arc followed by the point of the tool as a result of this feeding movement is indicated by the dotted circle at *J*. There is a flexible coupling in the horizontal feed-shaft *A*. Shaft *A* has a spur gear *B* on the outer end, which meshes with the feed-gear on the feed-screw of the planer. This arrangement provides an automatic feed which can be reversed by changing the position of the pawl on the reversible ratchet feed.

Shaft *A* drives shaft *D* through the bevel gears *C*. A worm on the end of shaft *D* meshes with a worm-wheel cut on the hub of the clapper-box *E*. This construction permits the tool secured in the clapper *G* to be rotated by the power feed, as previously mentioned. A heel brace extending from the lower end of the body of the tool to the under side of the cross-rail gives added strength and rigidity to the holder.

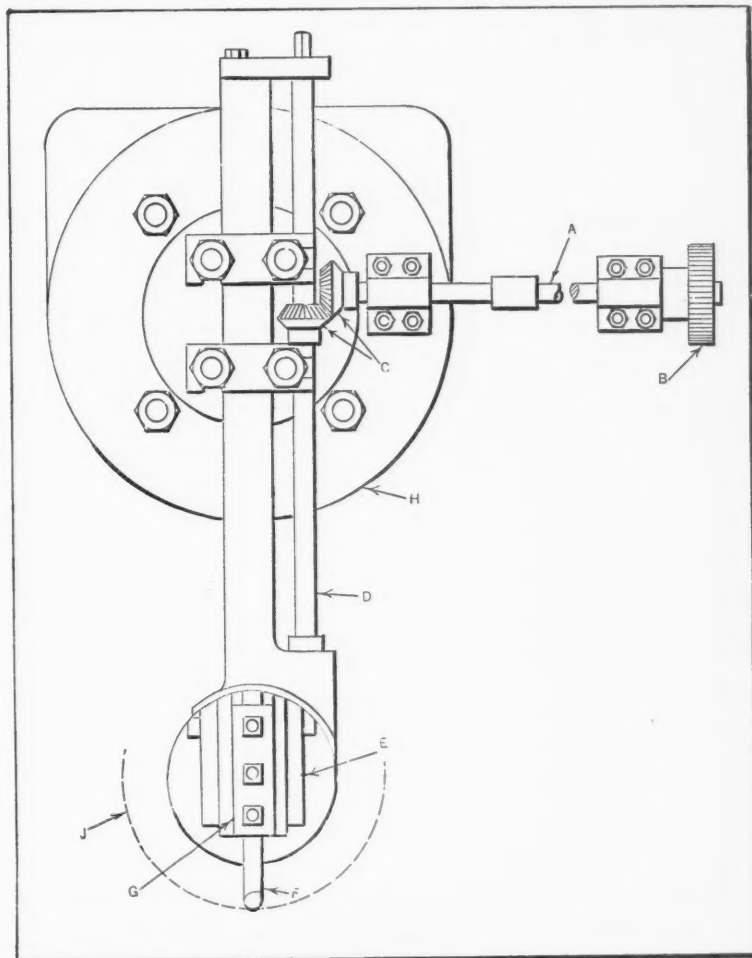
The mechanical feed relieves the operator of the necessity of feeding the tool around by hand, and gives a smooth, uniform finish. As the tool travels around through an arc of 180 degrees, the clapper-box is brought into a horizontal position at the ends of the radius cut. For this reason, it is necessary to employ a strong spring to swing the clapper-box back to the cutting position at the end of each return stroke. One end of the spring used for this purpose is generally secured to the tool, and the other end to a conveniently located bar.

The boxes to be machined are lined up on the planer table with a large angle-plate at one end which is bolted to the table. As many as sixteen boxes are planed at one time in some cases. The angle-plate is machined out to approximately the same outline as the work to be planed, to permit the tool-head to pass through. Two 1 1/8-inch rods which pass over the top of the work and two rods at the bottom serve to clamp the pieces securely to the angle-plate. A hold-down clamp is also provided for each side of every piece. The work can generally be finished in one roughing and one finishing cut. More time is required, of course, to finish cast-steel than cast-iron boxes.

Portsmouth, Ohio J. H. HAHN

## HOLDERS FOR SMALL DRILLS

A good arrangement for holding small drills in the turret of an ordinary-sized screw machine is shown in the illustration. The ordinary method of holding the drill is, of course, to mount it in a floating holder, but where there is a considerable difference in the relative proportions of the drill and machine, as in this case, the arrangement shown will be found much better. As the floating holder is clearly out of proportion to the drill and has no



Fixture for Planing Radius in Driving-boxes

## REMOVING PARTS FROM A SHAFT ROUGHED UP BY SET-SCREWS

While attempting to remove a clutch from a drive shaft recently, the writer found that the two set-screws in the hub had allowed the clutch to slip and a groove had been cut in the shaft. The sides of the groove were raised, forming ridges on the shaft which prevented the clutch from being removed. Although the clutch was heated and subjected to the blows of sledge hammers delivered simultaneously by two workmen, the part could not be driven off the shaft.

After the unsuccessful attempts to remove the clutch by driving, it occurred to the writer that the ridges raised on the shaft could be turned off by inserting a flat chisel in one of the set-screw holes and turning the clutch while holding the shaft stationary, or by turning the shaft and holding the clutch stationary. It only required a few minutes to turn off the ridges by using a chisel in this manner, after which the clutch was easily removed. The same method can, of course, be used for removing gears, pulleys, or any other part from shafts.

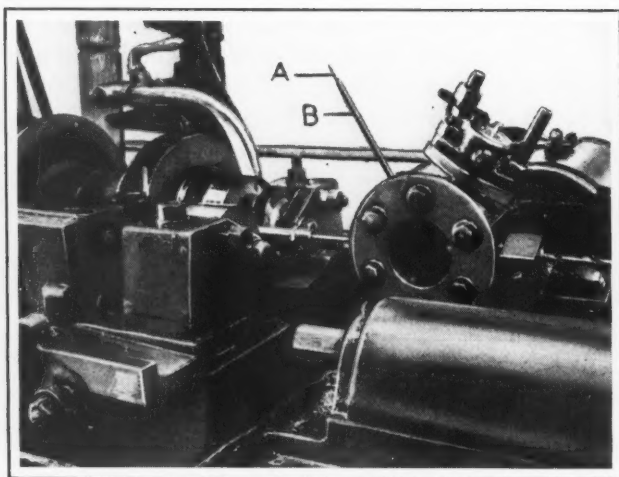
Lyells, Va.

W. R. WARD

flexibility, adjustment is rendered awkward and the liability of drill breakage increased. These disadvantages are entirely avoided by the very simple arrangement shown.

As will be seen, the idea consists simply in placing the drill *A* in an extension *B* of a type quite commonly used, the drill being held by solder, and in holding this extension, in turn, in a standard bushing clamped directly in one of the turret holes. This gives a long and slender support, which is just what is needed in this case. Because of the lightness of the tool, adjustment backward and forward is easy and sensitive, while due to the length of the holder, the drill can be instantly centered by merely bending the extension stem slightly with the fingers. All adjustments are therefore rendered quicker and more positive. An advantage just as great, however, is the flexibility of the shank, through which any undue strains on the drill are partly absorbed and breakage is greatly reduced, especially where a deep hole has to be drilled. This saving of drills helps to reduce costs.





Screw Machine Turret with Flexible Extension Holder for Small Drill

The drill, even if worn until just long enough to do its work, can easily enter the deepest hole that will admit the holder stem. This additional advantage of this type of holder is exemplified by the set-up illustrated, which shows two drills used in succession on a product so long that there would hardly be room for a floating holder.

Jena, Germany

HENRY SIMON

#### METHOD OF RELIEVING MILLING CUTTERS

Ordinarily, when a piece of special form or shape must be milled in a small shop, it is the practice to use a fly cutter formed to the required shape. Although the job can be done with a fly cutter, the operation is quite slow as the single cutting edge necessitates using a slow feed in order not to spring the holder and cause chatter marks on the work.

The writer has found that with the following method, multiple tooth cutters may be relieved quickly and evenly and the extra time required to make the cutter will be absorbed by the increase in

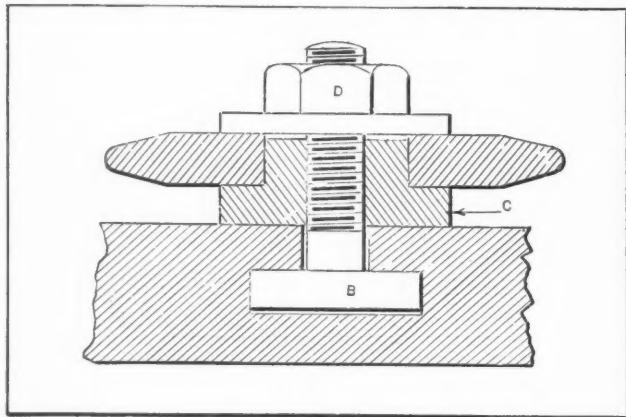


Fig. 1. Forming Cutter Mounted on Faceplate for Relieving Cut

production. The cutter is first bored and turned roughly to shape, after which it is gashed. It is then clamped to the outer edge of the lathe faceplate, as shown in Fig. 2.

The block A is formed to fit between the teeth of the cutter at the back, and serves to locate the teeth in the proper position for relieving. This block should be so placed that the tooth being relieved will be held below the center of the faceplate, so that the forming tool, held in the tool base, will

clear the succeeding tooth when set to the full depth, as shown by the dotted line E. As each tooth is formed, the cutter is removed and replaced in the proper position for relieving the succeeding tooth.

The clamp that holds the cutter to the faceplate is constructed as shown in Fig. 1. The head of the bolt B is made a close fit in the T-slot of the faceplate. The shouldered nut C screws over bolt B, locking it in position. Nut C is squared at the base to permit the use of a wrench for tightening, and is turned on the top end to fit the bore of the cutter, which is held in position by the nut D. This ar-

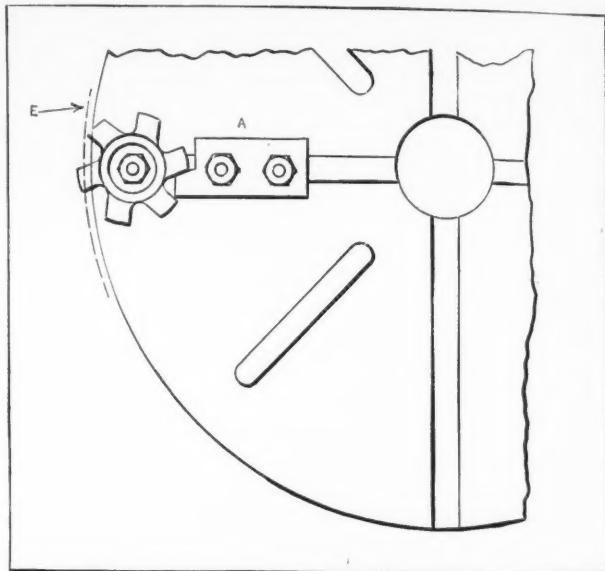


Fig. 2. Method of Securing Cutter to Faceplate

angement permits the cutter to be removed and replaced without changing its location.

Philadelphia, Pa.

R. H. KASPER

#### ATTACHMENT FOR DUPLICATING TAPER

It is unnecessary to eat baked beans every Saturday night and fish balls every Sunday breakfast to develop Yankee ingenuity. The kink illustrated was raised at the border on a distinctly Mexican diet. The device takes all the guess out of the job of boring gears, pulleys, etc., to fit shafts having an unknown taper. It consists of a rectangular block of steel A, Fig. 1, from one edge of which projects a threaded stud B. To the other edge of the block is fastened a piece of steel plate C. The blade of a cabinet maker's scraper was used, in this case, in making up plate C.

In use, the device is bolted to the side of the compound rest of the lathe, as shown in Fig. 2. The shaft or piece having the taper to be duplicated is

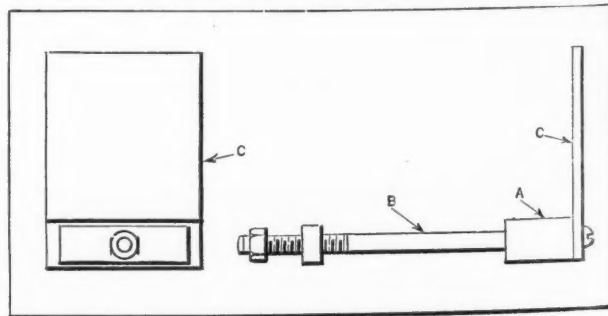


Fig. 1. Attachment for Use in Setting Compound Rest for Duplicating Taper

placed on the lathe centers with the small end of the taper nearest the tailstock, as in the case of the plug gage shown at A. The compound rest is then swiveled around until plate C bears firmly and uniformly against the tapered section. The compound rest is then clamped in place. The device is sufficiently strong to permit it to be jammed solidly against the work, and thus all backlash is automatically taken up.

The shaft is next removed from the lathe and the gear or coupling on which the taper is to be cut

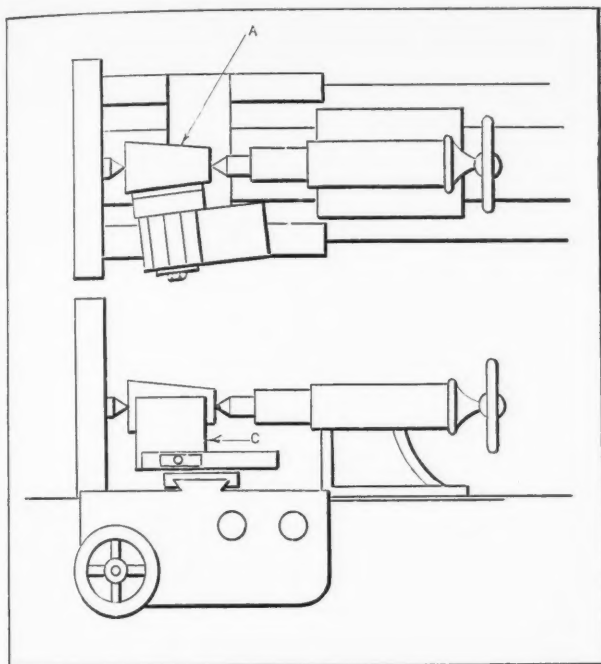


Fig. 2. Method of Setting Compound Rest for Boring Ring Gage to Fit Taper Plug A

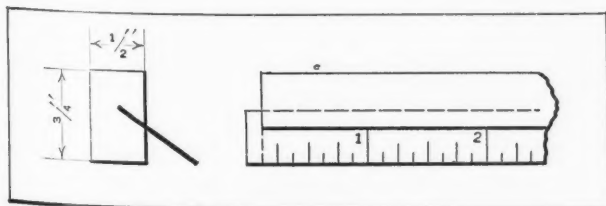
put in its place, the device being replaced by the boring tool. The boring cut can then be taken with the assurance that the taper will be the same as that on the work to be fitted. One of the advantages of using this method is that the lathe is run backward when taking the boring cut.

Willimantic, Conn. HERBERT A. FREEMAN

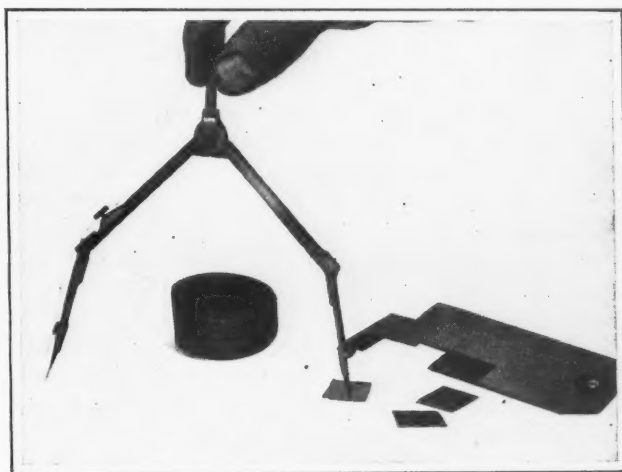
### SCALE FOR DRAFTSMEN

A handy scale for the draftsman can be made from a block of soft pine, 1/2 by 3/4 inch by about 5 3/4 inches long, and a 6-inch machinists' scale, mounted as shown in the accompanying illustration. A slot is sawed lengthwise in the block at a suitable angle. The scale is then inserted snugly in the slot, about 1/8 inch being allowed to project from each end of the block. This rule is very convenient when measuring from a straightedge or triangle.

Rochester, N. Y. CHARLES LEIBINGER



Machinist's Scale Arranged for Draftsman's Use



Pads for Compass Points

### PRACTICAL COMPASS POINT PADS

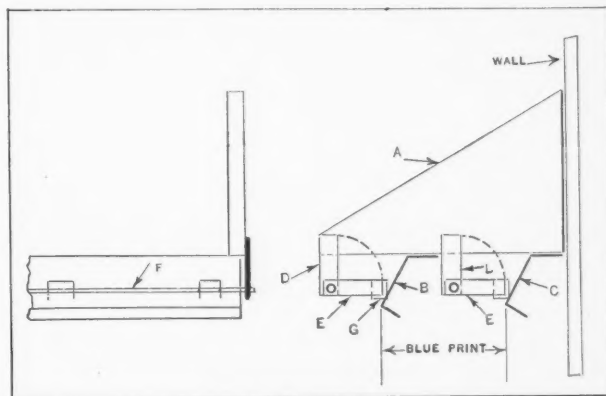
There are many methods of keeping the compass points from wearing large holes in light drawing or sketch paper. While doing shop sketch work on light paper, the writer hit on a scheme which is quite practical. A strip of electrician's adhesive tape is stuck to a heavy shipping tag, as indicated in the illustration. The tape and tag together are cut into about 3/8- to 1/2-inch squares.

Turning a square so the tape side is down, it is pressed firmly to the paper. The square stays where it is put, and affords a good bearing for the compass point. When the drawing is completed, the pad is pulled off. The tape leaves the paper clean, although it sticks securely while in place. A center in the paper for center and dimension lines is then quickly located by scribing from points in the circumference of any circle made from the pad point.

F. B.

### BLUEPRINT DRYING RACK

A convenient rack for holding blueprints while drying, after they have been removed from the wash tank, it shown in the accompanying illustration. It can be made either of wood or metal, de-



Blueprint Drying Rack

pending on which material is available. The rack shown was made for use in a drafting-room connected with a sheet-metal shop, and naturally is made of sheet metal.

The supporting brackets A are fastened to the wall at one side of the washer. The number of brackets required depends on the length of rack



required. Fastened to the under side of the brackets are bearing strips *B* and *C*, which extend the full length of the rack. These strips are simply metal pieces having one edge bent back to a right angle to give strength, and the other edge bent to an angle of 60 degrees so that the strip will stand at a 30-degree angle from the vertical when fastened to the brackets.

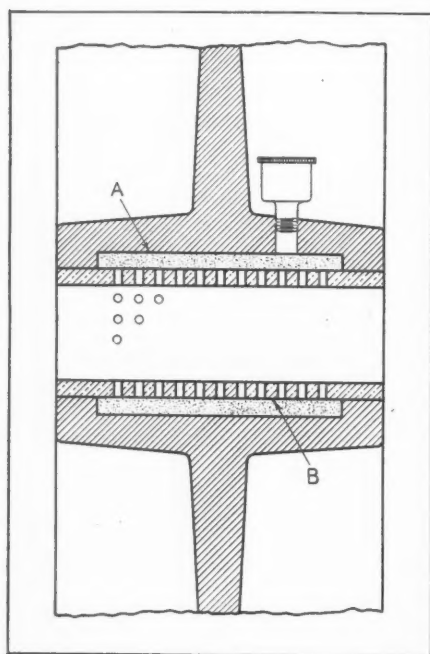
In front of the bearing strips are the rod supports *D*, which are fastened to the supporting brackets and carry the 1/4-inch rod on which the hinged clamps *E* are pivoted. The hinged clamps are made by forming a small channel from sheet metal and punching or drilling a 5/16-inch hole through both sides near one end for the 1/4-inch rod *F*. A small block of wood *G* is fastened inside the channel at the end opposite the pin-hole. The blue-prints are pushed up against the inside of the hinged clamps and past their ends, so that the clamps will bind the print against the bearing strips when they drop back.

St. Louis, Mo.

P. H. WHITE

#### SELF-OILING PULLEY BUSHING

The nearest approach to an oilless bearing that the writer knows of is shown in the accompanying illustration. Although the idea may not be new, the design shown has given complete satisfaction and is described here for the benefit of those who may wish to try it out on loose pulleys, etc. A



Self-oiling Pulley Bushing

recess or pocket *A* is bored in the hub of the pulley or other loose revolving part, and into this recess is inserted a soft felt packing which will just fill the space. A series of 1/8-inch holes is drilled in the ordinary bronze bushing *B*. The holes in the bushing should be spaced about as shown in the illustration.

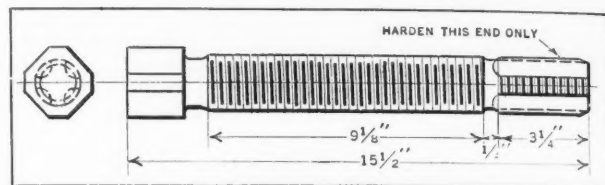
Baltimore, Md.

R. H. DAUTERICH

#### REDUCING SHRINKAGE OF STAYBOLT TAPS

When staybolt taps are hardened all over, the shrinkage in cooling often causes a decrease in the length that is equal to the pitch of one thread. In an endeavor to eliminate this inaccuracy, the concern by which the writer is employed conducted experiments which led to the adoption of taps having the tapping end hardened for a comparatively short distance. The remainder or guiding portion of the tap is left soft.

The illustration shows how a 1 3/4-inch staybolt tap with twelve U. S. standard threads per inch is made. Only the 3 1/4-inch length is hardened. The 9 1/8-inch length, which is left soft, is made approximately 0.005 inch smaller in diameter



Staybolt Tap with Only Short Tapping End Hardened

than the tapping portion. In back of the tapping portion there is a neck 1/2 inch wide.

In making taps of this style, the first operation consists of rough-turning all over, finish-turning, and chasing the thread at the cutting end, sufficient stock being left at this end for grinding the outside of the threads. In the second operation, the square end and the flutes are milled. The third operation consists of hardening the cutting end, and in the fourth operation, the threads on this end are ground. In the fifth and final operation, the threads are chased on the guiding portion, the thread being started at the left-hand side of the neck at the point where it would strike this edge if it extended continuously from the hardened end. It has been found that the shrinkage obtained in hardening the short cutting portion is negligible; consequently, trouble is no longer experienced from inaccurate taps.

Ridley Park, Pa.

WALTER R. MOORE

\* \* \*

#### LONG LIFE OF BELTING

A remarkable record made by leather belting is mentioned by Army Adams of Grass Valley, Cal. He states that in a stamp mill at the Liberty Bell Gold Mining & Milling Co. of Telluride, Colo., four 50-horsepower motors, each pulling twenty stamps 24 hours per day for 363 days in the year, were employed. On one of these motors there was a 10-two-ply, endless leather belt, traveling from a 16-inch crowned driver to a 60-inch drive pulley on a countershaft. From November, 1905, until 1918, during which time Mr. Adams was with the company, this belt was pulling its load of 50 horsepower. How long the belt had been running before his connection with the company he does not know, but thirteen years of continuous service is a good record for a leather belt. It is evident that the belt received the best of care, otherwise it could not have given such service. As a matter of fact, the belt continued in operation until the mill was dismantled in 1920 or 1921.

# Shop and Drafting-room Kinks

## MAKING A SLOTTING CUTTER CUT LARGE

A slotting cutter can be made to produce a slot slightly wider than its thickness, and thus eliminate the necessity for making two cuts. To do this, it is simply necessary to mount the cutter at an angle with the arbor. For example, a slot 0.140 inch

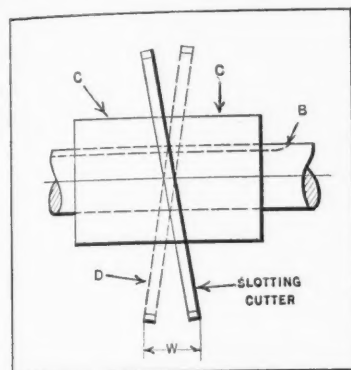


Diagram Illustrating Method of Making Cutter Produce Wider Slots

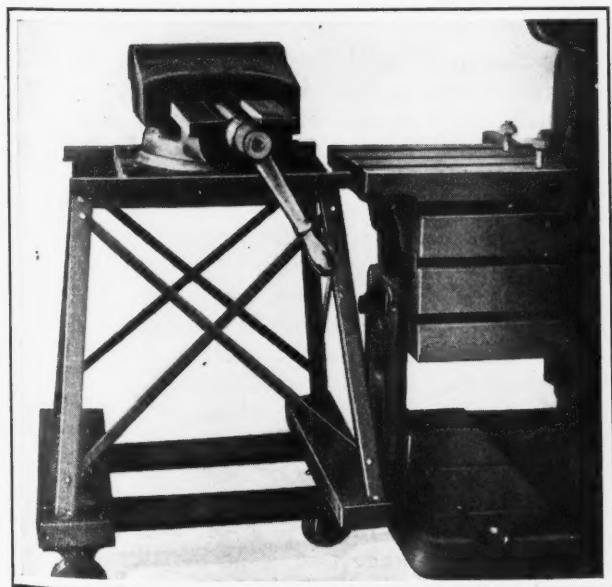
wide can be cut with a saw 0.125 inch thick by grinding the adjoining faces of the arbor collars to a slight angle, the exact angle being determined by trial. When the slotting cutter is held between the angular faces of the collars, it will wobble as the arbor is revolved. It is this action that causes the cutter to cut large. The angular position of the cutter is shown greatly exaggerated in the accompanying diagram, where *W* represents the width of the slot cut, *C* the angular-faced collars, and *D* the position of the cutter after one-half revolution of the arbor *B*. In this case advantage is taken of a condition that ordinarily is a source of trouble.

Hartford, Conn.

F. EDWARDS

## STAND FOR SHAPER VISE

The device shown in the accompanying illustration has proved to be a useful shop accessory. It provides a convenient holder for the shaper vise when it is necessary to remove it from the shaper table in order to clamp work directly to the table.



Shaper Vise Stand

Shaper vises are often very heavy, and a light metal stand, such as illustrated, eliminates difficulty in handling them, as well as the danger of leaving the vise on the floor, where it may be tripped over.

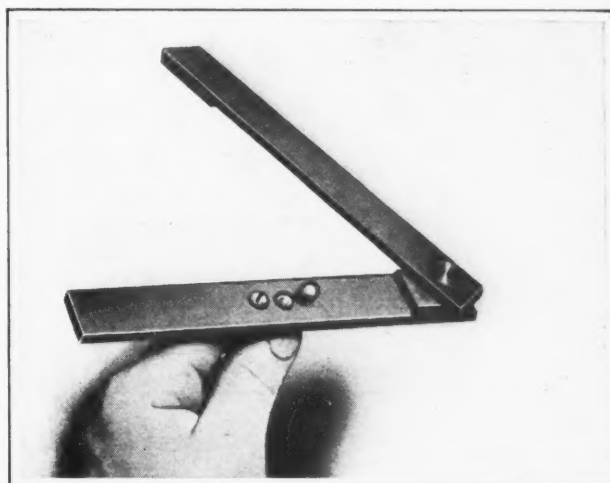
The stand is made of light angle-iron, riveted together and mounted on three or four heavy casters, two of which may be of the non-swivel type. The top of the stand is provided with ways made by welding two pieces of angle-iron on top, at a suitable distance apart, so that the vise base may be easily slid between them. The height of the stand, up to the ways is about the height of the top of the shaper table from the floor, when in its most used position.

Newton, Iowa

GEORGE W. WILSON

## HOLDER FOR GRINDING SCREW ENDS

Finding it necessary to grind a couple of threads off the ends of a large quantity of short screws,



Holder Used in Grinding off Screw Ends

the writer made up the rough holder shown in the accompanying illustration for holding the work during the grinding operation. This holder accommodates three screws at a time, and is made from two pieces of flat stock. Each of the flat pieces is bent over double at one end. After placing the doubled ends opposite each other, a hole was drilled through both pieces at one end.

A rivet through the drilled hole serves to hold the parts together. The three holes that receive the screws to be ground are large enough to permit the screws to be easily put in place. The two members of the holder are swung apart, as shown in the illustration, to permit loading or unloading. The ends of the holder are gripped in the hands while the screws are brought into contact with the grinding wheel. The plain half of the holder takes the thrust of the screw heads when the work is pressed against the wheel.

Hamilton, Ontario, Canada ARTHUR KENDALL



# Questions and Answers

## MEASURING TAPER GAGE

C. E.—A taper gage with beveled sides, as shown in Fig. 1, is required. What is the most practical and convenient method of checking or inspecting the accuracy of this gage? A method that can be used in the ordinary tool-room or inspection department, under everyday practical conditions, is required.

Answered by E. C. Cooley, Syracuse, N. Y.

The first step in measuring the gage shown in Fig. 1 is to check the 5-degree and 20-degree angles. To do this, the gage *A* is mounted on an angle-plate, as shown in Figs. 3 and 4. The accurate parallels *C*

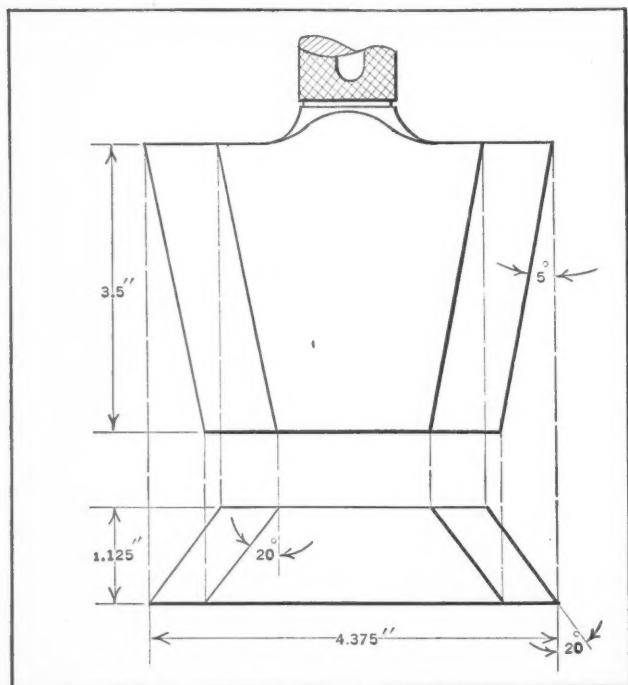


Fig. 1. Taper Gage to be Inspected

and *D* are clamped to angle-plate *B*. Parallel *D* is accurately positioned with the side at *H* perpendicular to the surface plate *G*. Surface *H* then serves to square up the gage with the surface plate, it being assumed that the end of the gage is ground square or at right angles with the center line *X*, and that this surface was used as a base when making the gage.

After clamping the work in position, six balls *E*, each 1 inch in diameter, are placed in position, as indicated in the illustration. Now, referring to the view at the left, the ball to the right should be 0.3420 inch higher than the one directly to the left, for we have in triangle *abc*

$$bc = ab \times \sin 20 \text{ degrees} = 0.3420$$

This difference in height can now be checked with a height gage.

Referring to the view at the right in this illustration, the same method can be employed to check the 5-degree angle. In this case, we find the difference in height between the two end balls of

either row to be 0.1743 inch. The position of the gage is then reversed, and the angles on the other side checked in the same manner.

The next step is to set up the gage as shown in Fig. 2 for checking the width dimension 4.375 inches, using two 1-inch balls. The set-up is so made that the centers of the balls lie in a line 0.250 inch below the surface *F* and 0.250 inch back from the wide face of the gage. The width of the gage as measured on its center line must now be calculated. In the diagram Fig. 5 is indicated the method of calculating the length of a line across the top of the gage 0.250 inch back from the front face.

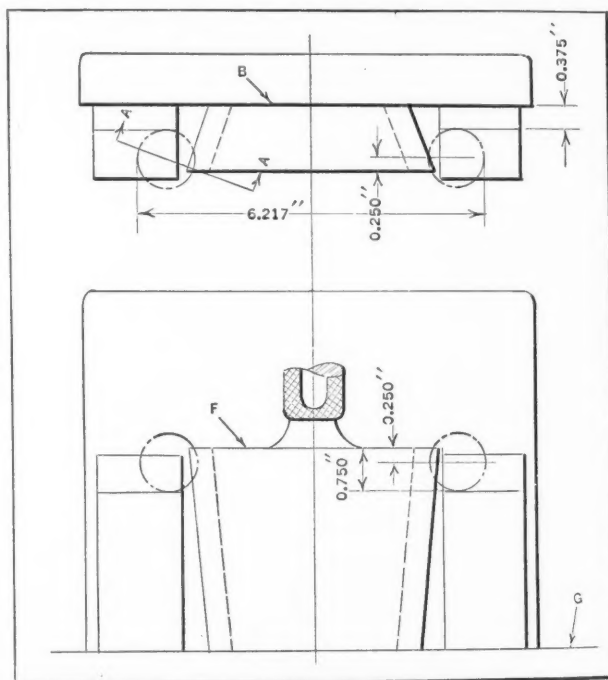


Fig. 2. Set-up for Checking Angles of Taper Gage

The diagram Fig. 6 indicates the method of obtaining the required thickness through the gage at a point 0.250 inch below the 4.193-inch dimension. The required thickness, as thus obtained, is 4.14925 inches. Having thus obtained the exact thickness of the gage along the center line of the balls, we next proceed to find the distance from the center of the ball to the gage, along the center line.

Because of the compound angle, the balls make contact with the gage above, as well as to one side of, their common center line. It is clear that the balls touch the gage at some point in the plane of line *A-A*, Fig. 2, which is at an angle of 20 degrees to the surface of angle-plate *B* and is perpendicular to the surface or base plate *G*.

The diagram Fig. 7 indicates the method of calculating the angle in plane *A-A*, Fig. 2, between the face of the gage and a perpendicular to the surface plate *G*. This angle is 4 degrees 42 min.

The diagram Fig. 8 shows the ball making contact above the center. The distance from the cen-

ter of the ball to the gage on a horizontal line in plane A-A, Fig. 2, is equal to 0.500 times the secant of the angle 4 degrees 42 minutes which is equal to 0.5017 inch.

Fig. 9 is a section diagram indicating the method of obtaining the distance from the center of the ball to the face of the gage along the center line of the balls. From this diagram it is clear that this distance equals 0.5017 times the secant of the angle 20 degrees or 0.5339 inch.

We now know all the components of the line between the centers of the balls, namely, twice the radius of the ball, which equals 1.0000 inch; twice the distance from the center of the ball to the gage, which equals 1.0678 inches; and the thickness of the gage on the center line passing through the balls, which equals 4.1492 inches. The sum of these components, which equals 6.2170 inches, is the measurement over the balls, as indicated in Fig. 2.

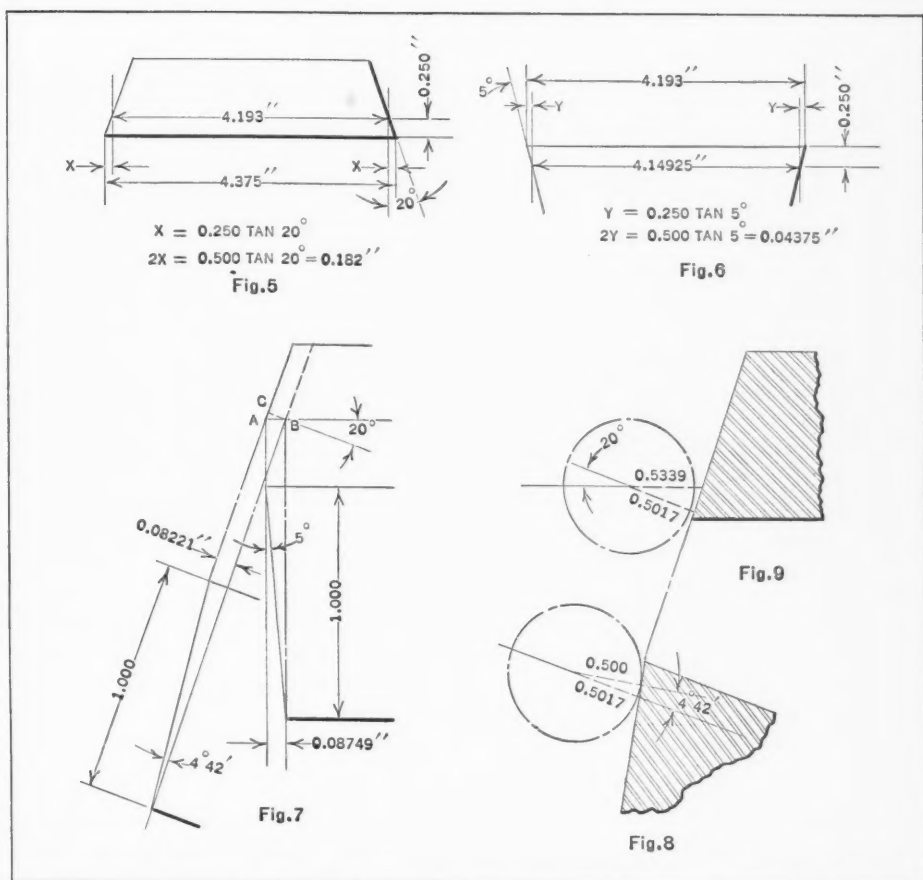
While the explanation is necessarily rather long, the actual operations are simple. By employing 1-inch balls, the calculations are simplified, and in most instances results can be read directly from the trigonometric tables. It will also be noted that the

balls remain in position without requiring any clamping or fastening.

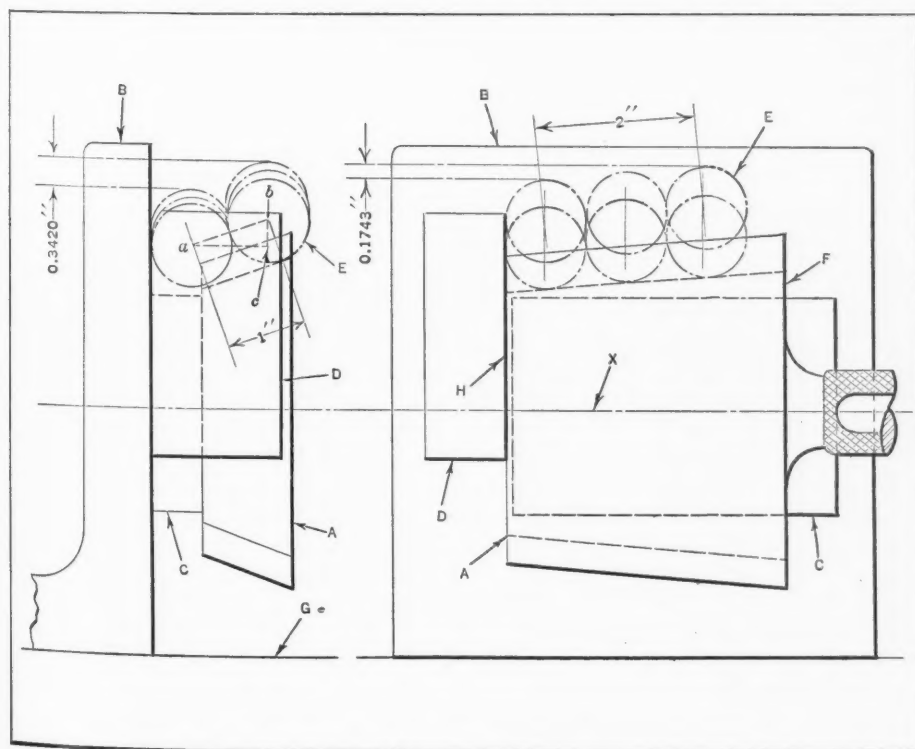
[The resultant angle formed between the common center line of the two balls and a line from the center of one of the balls to its point of contact with the gage can be readily calculated by a formula on page 53 of MACHINERY's book "Draftsman's Mathematical Manual." With this angle known, the distance from the center of the ball to the gage along the common center line can be easily obtained.—EDITOR]

\* \* \*

Automatic power plants are now not unusual, but it may be news to many that very large hydro-electric plants are now operated in this manner. One such plant has recently been completed in British Columbia at an expenditure of \$2,500,000 and is owned by the British Columbia Electric Railway Co. There is a single generator in this plant of 12,500 horsepower capacity which is completely controlled from another power house located 11 1/2 miles away.



Figs. 5, 6, 7, 8 and 9. Diagrams Used in Making Calculations Required in Checking Gage Shown in Fig. 1



Figs. 3 and 4. Front and Side Views of Gage with Balls in Position for Checking Taper



# Estimating Production Costs

By HERBERT W. CABLE

WHENEVER a new device or invention is to be placed on the market or an article that is being manufactured is improved or changed radically, a detailed production-cost estimate is of considerable value for determining the selling price and for purposes of comparison. Such an estimate is also essential in setting up manufacturing processes. The plant lay-out can be made directly from the information, all tools designed, and the number and types of employees determined. In fact, the estimating of production costs should be the first move in establishing well-organized manufacture. This article will outline a procedure of cost estimating and will present forms designed

After this information has been gathered and the various points mentioned have been considered, a parts list, such as shown in Fig. 1, should be made up, giving each part a number and specifying the number of parts of each kind required, the sort of material, the weight, and the material cost. Sub-assemblies and complete assemblies are also given numbers and afterward considered as units. This greatly facilitates all subsequent work.

Next, considering each part separately, the manufacturing operations may be planned on the routing sheet illustrated in Fig. 5, and each operation given a number. Routing sheets are also filled out for sub-assemblies and the final assembly, in detail.

PARTS LIST													
PART NUMBER	PART NAME	NO. OF PIECES PER UNIT	NO. OF MINUTES PER PIECE	NO. OF MINUTES PER UNIT	MATERIAL	WEIGHT PER PIECE, POUNDS	TOTAL WEIGHT, POUNDS	PRICE PER POUND	COST PER PIECE	TOTAL COST	SPECIAL TOOL COST		PERISHABLE TOOL COST
1000	Bracket	1	4.20	4.20	Mall	9.5	9.5	0.05	0.475	0.475	625	00	98 00
1001	Base	1	5.60	5.60	6.9	15.0	15	0.04	0.600	0.600	1000	00	125 00
1002	Shaft	1	9.28	9.28	J.S.	2.5	25	0.30	0.750	0.750	500	00	75 00
1003	Pulley	1	3.00	3.00	6.7	5.0	5.0	0.04	0.200	0.200	300	00	50 00
1004	Assembly		10.00	10.00							100	00	25 00
	Totals			32.08						2025	2525	00	373 00

Fig. 1. Form on which All Parts of a Device may be Listed, together with Essential Information

to facilitate the work. The estimates shown are hypothetical, for obvious reasons.

The first step in making an estimate is to obtain complete drawings and specifications of the device to be produced, which give information concerning manufacturing limits, special operations, workmanship required, estimated daily production, shipment requirements, etc. If the manufacturing is to be done in a plant already equipped, a complete list of the equipment and a lay-out of the plant are desirable. Which parts are to be made and which are to be purchased should be determined, and special processes to be performed by outside concerns should be considered.

Finished and unfinished samples of each part of the device are valuable aids in determining costs, weights, and other factors. All improvements or changes that could be made in the design of the device to cheapen production should be carefully considered before starting the final estimate.

Care should be taken to see that all special operations are listed and that proper inspection is provided for. The daily production of the machines; locating points of the work in jigs, fixtures, etc.; group and quantity operations; manufacturing limits; handling methods; types of labor; and in fact, the whole manufacturing procedure must be visualized at this time in order to attain proper results.

After this has been done, each operation should be studied individually on the planning sheet shown in Fig. 6. The machine tools and other commercial equipment to be used are determined after considering the available equipment and processes, as well as the factory layout. Each operation should be divided into sub-operations, and the actual method of machining planned. Types of fixtures to be used, the number of pieces that can be held in the fixtures, machine speeds, and machine feeds must be considered.

LIST OF COMMERCIAL PARTS					
ASSEMBLY NO.	QUANTITY	DESCRIPTION	PRICE PER PIECE	TOTAL COST	REMARKS
1004	4	1/2" Hexagon-head Cap Screws			
		1 1/2" long - 13 threads per inch			
	1	No. 9 Woodruff Key			
	1	1/2" Hexagon-head Cap Screw			
		1" long - 13 threads per inch			

Fig. 2. Form on which the Commercial Parts Required for Sub-assemblies are Itemized

The time required for setting up the machines should be studied; however, it is unnecessary to include this item in the operating time, except for short runs and low production, in which cases it is divided by the total quantity of the run to obtain the additional time per piece. The time for each sub-operation is estimated, and the total transferred to the routing sheet illustrated in Fig. 5. The special equipment is also listed at this time on the routing sheet, and its maximum cost estimated.

### Working gages

SUMMARY			
		PRODUCTION TIME, MINUTES	MATERIAL COST
TOTALS	SHEET 1	32.08	\$2.025
	" 2		
	" 3		
	" 4		
	" 5		

TOTAL PRODUCTION TIME 32.08 MINUTES  
PLUS 200% FOR OVERHEAD 64.16 "  
PLUS 25% FOR AVERAGE CONDITIONS 8.02 "  
TOTAL TIME 104.26 "

TOTAL TIME MULTIPLIED BY STANDARD RATE PER MIN. OF  $\$0.01 = \frac{\$}{104.26}$   
TOTAL MATERIAL COST 2.025  
TOTAL COST OF COMMERCIAL PARTS 0.200  
MANUFACTURING COST \$3.268

TOTAL MACHINE TOOL COST \$3200.00  
TOTAL COST OF SPECIAL EQUIPMENT 2898.00  
COMPLETE EQUIPMENT COST 6098.00  
YEARLY DEPRECIATION AT 20 PER CENT 1219.60  
YEARLY PRODUCTION 90,000  
EQUIPMENT COST PER UNIT 0013

TOTAL PRODUCTION COST PER UNIT \$3.281

and perishable tools, such as cutters and taps, should be itemized on the planning sheet. The percentage of time that each machine should be employed to give the desired daily output should also be determined and entered in the column provided. When the routing for each sub-assembly is considered, the commercial parts required should be entered on the form illustrated in Fig. 2. The prices per piece and the total costs may be determined later.

After obtaining the various totals for each

**Fig. 3. Form Employed for Summarizing the Costs of a Unit**

[illegible]

Fig. 4. Sheet on which are Listed Various Data Concerning the Machine Tools Required for the Different Parts



part or assembly, the parts list shown in Fig. 1 can be completed, and all extensions made and totaled. The machine tool list shown in Fig. 4 is next drawn up from the routing sheets, and the time that each machine will be required, in order to obtain the daily production, is entered under the respective part numbers.

It may be discovered at this point that certain equipment will be required only part of the time, and in order to reduce the number of machines used, as well as to eliminate idle machine time, the routing and planning sheets should again be studied with a view to employing other types of equipment. If the planning has been done correctly and this point has been kept in mind, little changing should be required. The total number of machine tools necessary can thus be determined, and their costs estimated.

The summary illustrated in Fig. 3 is finally filled out, the total production time, material cost, tool costs, etc., being taken from Fig. 1. Two hundred per cent of the labor cost is added for overhead, and 25 per cent for average shop conditions, fatigue factors, etc. For new projects, the special equipment is usually written off in five years. Dividing the depreciation charge by the yearly production and adding the result to the manufacturing cost, gives the total cost per unit of the device considered. Real estate, buildings, and general factory equipment are included under the general heading of overhead. After the first supply, the perishable tools should be considered part of the overhead or maintenance cost.

To obtain satisfactory results, the estimating of production costs should be done thoroughly by an engineer whose experience and knowledge qualify him to make accurate estimates. It is easy to omit essential points, and the engineer should carefully check himself at each step to make sure that he has included everything and that his results are logical.

\* \* \*

PROPORTIONS OF SLOTTED SCREW HEADS

A proposed American standard for slotted head proportions has recently been completed by a subcommittee of the Committee on the Standardization of Bolt, Nut and Rivet Proportions. This proposal is now being submitted to the industry and trade in general for approval. Those interested in the subject may obtain copies of the proposed standard from C. B. LePage, assistant secretary, American Society of Mechanical Engineers, 29 W. 39th St., New York City. Suggestions and criticisms for any changes in the proposed standard are invited.

TRAINING FACTORY INSTRUCTORS

By S. KUPPER

In addition to the training of apprentices, interest in which has been revived with remarkable success by several shops, factory training for all workers is most desirable. The purpose of factory training is to create a proper mental attitude toward the job and the employer, and to form good working habits.

The most important thing to consider is the se-

ROUTING SHEET							
PART NO. <u>1000</u>		NAME <u>Bracket</u>		MATERIAL <u>Mall.</u>			
WEIGHT PER PIECE, LBS. <u>9.5</u>		PIECES PER UNIT <u>1</u>		UNITS PER DAY <u>300</u>			
TOTAL MINUTES PER PIECE <u>4.20</u>		TOTAL MINUTES PER UNIT <u>4.20</u>					
OPERATION NUMBER	OPERATION NAME	MACHINE TOOL	SPECIAL TOOLS	ESTIMATED TOOL COST	NO. OF MINUTES PER PIECE	NO. OF PIECES PER HOUR	PER CENT OF TIME MACHINE IS USED
1	Mill face + Bore	24" 6 in Duplex	Fixture	100	1.50	40	100
		Miller	2-6" Dia. Face	25			
			Milling Cutters				
2	Drill + Ream Two Holes	21" 6 in 4 Sp	4 Tigs	300	1.25	48	100
		Gang Drill	1 1/2" Bore Drill	15			
			1 1/2" Reamer	20			
			3/2" Drill	12			
			7/8" Reamer	8			
3	Drill + Tap Bolt Boss	3 Sp. Allen	Jig	100.	0.95	63	75
		Gang Drill	1/2" Drill	5.			
		Tap Attach.	7/16" Drill	5.			
			1/2" Tap 13 Threads	5.			
4	Saw Slot	24" 6 in Auto.	Fixture	125.	0.50	120	50
		Miller	3-4" x 1/8" Saw	3			
	Inspect						
		Totals					
		No. of minutes per pc.			4.20		
		Special Tools		625			
		Perishable Tools		98			

Fig. 5. Routing Sheet which Facilitates Planning the Manufacture of Parts

lection of the man who is to direct this training work. The instructors themselves, who should be selected from the expert workers of the factory, must be given a systematic and thorough course in teaching that is applicable to the training of factory workers.

This instruction course for the instructors might be conducted at the close of the day for two or three hours each week, covering a period of three or four months, before they engage in their teaching duties. The course should be carefully planned, and while it should be in charge of a professional teacher, it is advisable that the latter becomes thoroughly familiar with the surroundings of the workers in order that he fully understand his task. The lesson should include the analysis of the various elements

of a job, so as to make logical and systematic teaching possible. Not many instructors know how to supervise learners, or how to follow them up after they have been trained.

Proper training for factory instructors will enable them to better carry on their work. It will develop a favorable attitude toward the job on the part of a new employe or a learner, which is essential if excessive labor turnover is to be prevented. The training can be carried on without additional outlay for tools or equipment, yet it makes both

INDUSTRIAL MACHINERY EXPORTS

The upward trend in industrial machinery exports continues. During May, the last month for which complete statistics are available, the exports reached a total value of \$19,000,000, as compared with \$16,226,000 for April. Compared with May a year ago, a gain of 25 per cent is recorded. The shipments of industrial machinery for the first five months of 1928, according to the Industrial Machinery Division of the Department of Commerce, are now more than 10 per cent in excess of the corresponding period of 1927.

During May, the exports of metal-working machinery reached a total of \$2,548,000, as compared with \$1,892,000 for May, 1927. The total exports of metal-working machinery amounted to \$12,247,000 during the first five months of the year. Probably the largest gain in the metal-working machinery and machine tool group for the first five months of this year, as compared with the first five months last year, was made by lathes, the exports of which increased from \$984,000 to \$1,624,000, and by drilling machines, where the exports rose from \$298,000 to \$488,000.

\* \* \*

REMOVING TIGHT BEARINGS

By JOHN A. MALM

Referring to the method of removing tight bearings from "blind holes," described on Page 697 of May MACHINERY, the writer suggests that a simpler and quicker way to remove the bearing would be to use the oil method. Simply fill the bearing about half full of oil and insert a fairly tight wood plug above the oil. A hard blow on the plug with a sledge or heavy hammer will create sufficient pressure at the inner end of the bearing to force it out. The wood plug can be quickly turned to the required size by the patternmaker. This method requires no special equipment and is quickly applied.

\* \* \*

An association known as the Gray Iron Institute has been formed with Walter L. Seelbach of the Forest City-Walworth Run Foundries Co., Cleveland, Ohio, as president; and Arthur J. Tuscany as secretary-manager. The Gray Iron Institute has been incorporated to promote the interests of the gray iron foundry industry. Its work will include the promotion of sound business ethics, the collection and distribution of information on the manufacture of gray iron castings, the merchandising of castings and the development of new markets, the promotion of uniformity in cost accounting, research work to improve quality, and the establishment of standards of quality and performance.

PLANNING SHEET				
OPERATION NO. <u>2</u> PART NO. <u>1000</u> MATERIAL <u>Malleable Iron</u>				
MACHINE USED <u>Four-spindle Gang Drill</u>				
SUB-OPERATIONS, TOOLS, RECOMMENDATIONS, ETC.	DEPTH OF CUT, INCHES	SPEED, FEET PER MINUTE	FEED, INCHES PER MINUTE	ESTIMATED TIME, MINUTES
<u>Set Drills in Spindles</u>				<u>1.50</u>
<u>Locate figs on Table</u>				<u>1.50</u>
<u>Clamp figs on Table</u>				<u>1.50</u>
<u>Adjust Height and set Stops</u>				<u>1.00</u>
<u>Change Spindle</u>				<u>0.50</u>
<u>Set up Time</u>				<u>6.00</u>
<u>Pick up Piece and Clamp in fig</u>				<u>0.10</u>
<u>Drill Hole at 200 R.P.M.</u>	<u>2"</u>	<u>90</u>	<u>320</u>	<u>0.65</u>
<u>Remove Piece</u>				<u>0.10</u>
<u>Clean fig</u>				<u>0.10</u>
<u>Time per Piece</u>				<u>0.95</u>
<u>4 figs on Table - Time of One</u>				
<u>Piece Equals Longest Operation</u>				
<u>Assuming Run of 3000 Pcs. Set up</u>				
<u>Time is Neglected</u>				

Fig. 6. Planning Sheet on which the Details of Operations are Listed

tools and equipment more efficient, if the worker is adjusted to his duties more rapidly, and if he appreciates quickly the part he plays in the organization.

The wise executive will soon recognize that a plan for factory training of workers aids in production, makes it possible to develop and retain first-class men, and promotes satisfactory relations all around; but he will also recognize that good factory training can only be accomplished through trained and efficient factory instructors.

\* \* \*

The closed car production for 1927 amounted to 83 per cent of the total automobile output. The old well-known touring car is practically a thing of the past.



## AMERICAN STANDARDS ASSOCIATION

The name of the American Engineering Standards Committee, which has been the final court of approval of national standardization work in this country, will be changed to the American Standards Association. The headquarters will continue to be located at 29 W. 39th St., New York City. The reconstructed body will include a federation of national organizations. In this way trade associations interested in standardization may more readily join in the standardization movement. The technical work of approving standards will be handled by a Standards Council and the administrative and financial responsibility will be in the hands of a board of directors composed of twelve industrial executives. The Standards Council will be composed of not more than three representatives of each of the member bodies, each representative serving for a period of three years.

The underlying principles of the American Engineering Standards Committee will remain unchanged. The basic functions remain completely in the hands of the representatives of the member bodies. The individual members, whether of the board of directors or of the Standards Council, are appointed or nominated by the member bodies. The name American Standards Association is being adopted as more accurately descriptive of the reorganized association.

\* \* \*

## THE WORLD'S LARGEST NAVAL VESSEL

The U. S. S. *Lexington*, the largest and highest-powered naval vessel in the world, is just about completed. This ship belongs to the group of electrically driven vessels which includes the *Maryland*, *West Virginia*, and *Saratoga*. The *Lexington*, like the *Saratoga*, is an airplane carrier. Originally, it was intended for a battle cruiser, but due to the modification of the naval program, the ship was converted into an airplane carrier. The flying deck has an unbroken flying surface 900 feet long. Special provision is made on the deck floor whereby landing planes can be stopped within a distance of a few hundred feet. The *Lexington* will be propelled by electric machinery developing 180,000 horsepower. The vessel is the longest naval ship in the world, being 874 feet long, with a beam of 105 feet. Her displacement is 33,000 tons. The ship contains more than 600 separate "rooms," each of which is supplied with a loud speaker, so that from any one of several central stations about the ship, any person on board may be immediately reached. It is stated that the *Lexington*, when completely equipped for service, will have cost the government of the United States \$45,000,000.

\* \* \*

The railways of the United States in 1927 bought 6,125,000 tons of steel. The building industries used 7,000,000 tons.

## TAPER-BORING CAST-IRON CYLINDERS

The taper-boring of large cast-iron cylinders like the one shown at A, Fig. 1, is an interesting example of the adaptation of a standard type machine tool to a rather unusual production job. This work is done by the Shaw Crane-Putnam Machine Co., Inc., at the Putnam Machine Co. Works, Fitchburg, Mass. The cylinder has a wall thickness of  $\frac{9}{16}$  inch, and it is required to be taper-bored to a diameter of  $21\frac{3}{4}$  inches at the large end, tapering to a diameter of  $21\frac{5}{8}$  inches at the smaller end. The length of the tapered bore is 6 feet. Two cuts are taken—a roughing cut with a feed of  $\frac{3}{16}$  inch per revolution of the boring-bar, and a finishing cut at a feed of  $\frac{3}{8}$  inch per revolution, using a finish-boring tool. The floor-to-floor machining time, using the feeds mentioned, is five hours. The

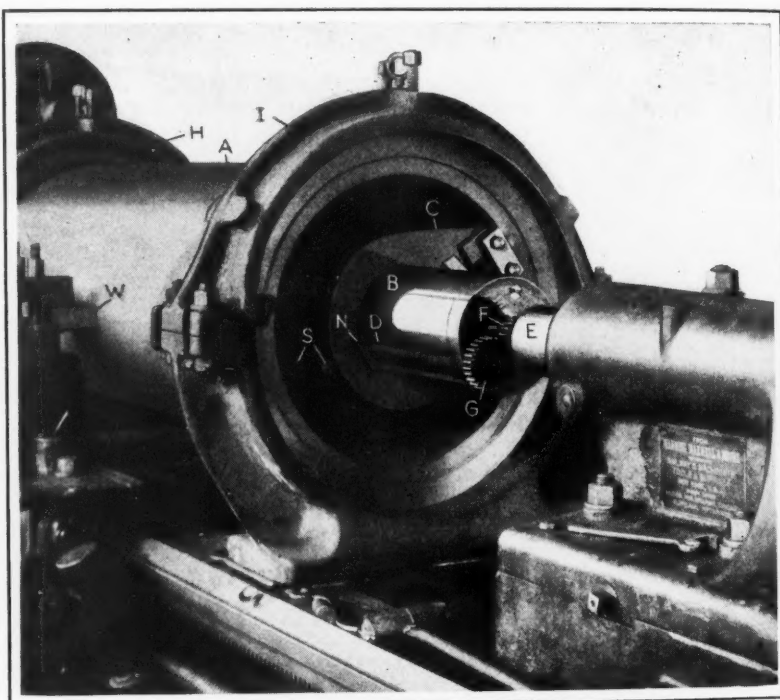


Fig. 1. Geared-head Lathe Equipped for Taper-boring Large Cast-iron Cylinders

work is handled on a Putnam 36-inch geared-head lathe.

The special tool equipment is simple, consisting primarily of a boring-bar *B*, bolted to the lathe faceplate, a tool-head *C* fed along the boring-bar by screw *D*, a tailstock center *E* provided with a fixed gear *F* which meshes with a gear *G* on the feed-screw *D* of the boring-bar, and two work-rests *H* and *I* mounted on the lathe ways.

The taper of  $\frac{1}{8}$  inch in six feet is obtained by having the flanged end of the boring-bar bolted to the faceplate in an off center position, and the outer end supported on the tailstock center *E*, which is in line with the center of the lathe spindle. The boring-bar is thus mounted at a slight angle with the faceplate, which causes the tool to bore the work to the required taper. The angle *T* between the axes *X-X* and *Y-X*, as indicated in Fig. 2, is somewhat exaggerated in order to show more clearly the exact conditions.

In making the boring-bar, the bar was first turned to size on centers, with the work rotating

about the center line X-X. After completing this operation, a new offset center was made on the flanged end, the locating boss K turned, and the flange faced with the work rotating about the axis Y-X. The boss K provides an accurate means of locating the boring-bar on the faceplate.

Referring to Fig. 1, the work is held stationary in the rests H and I, the upper half-members of which serve as clamps. Two centers E and two gears G are included in the equipment. One set of gears F and G, which give a feed of  $\frac{3}{16}$  inch per revolution of the boring-bar, is used for the roughing cut. The other set, giving a feed of  $\frac{3}{8}$  inch per revolution, is used for the finishing cut.

The half-nut N, which is secured to the boring head by cap-screws S, serves as a driving key as well as a feed nut. By simply removing screws S, the boring head is allowed to slide freely on the

## THE FOREMAN AS A PSYCHOLOGIST

By CHARLES SPRAGUE HAZARD

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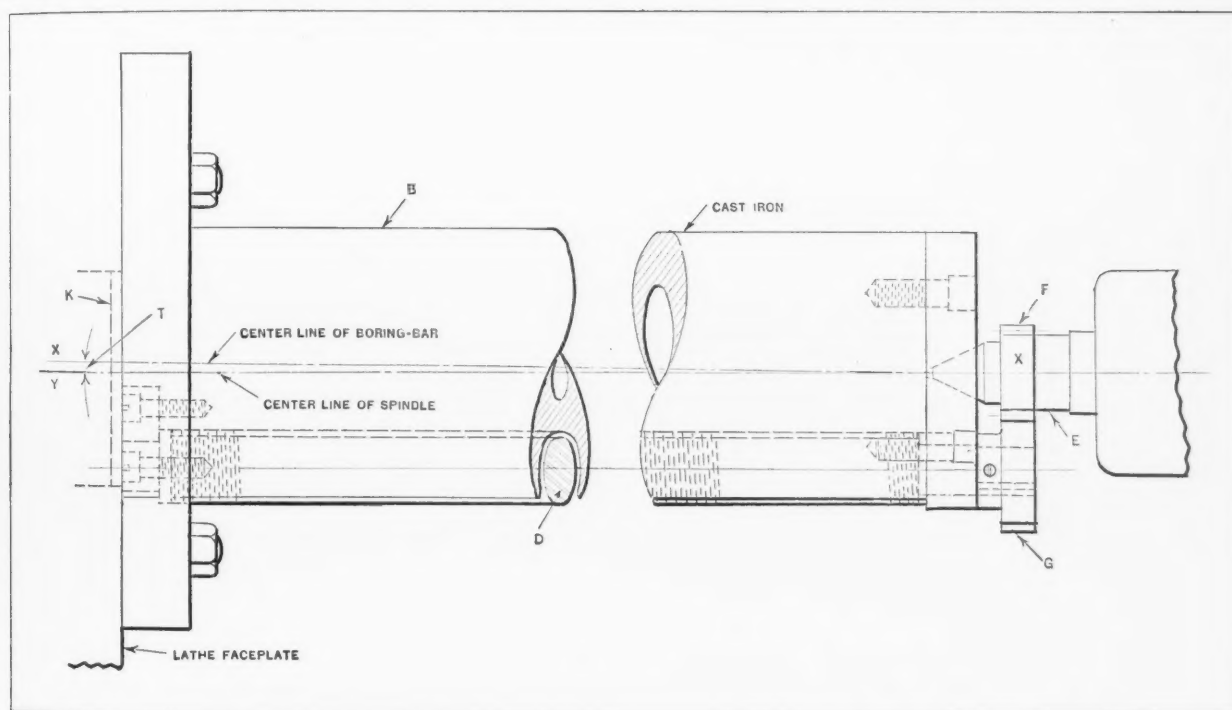


Fig. 2. Diagram Showing Constructional Details of Boring-bar B, Fig. 1

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A statement published by the American Automobile Association mentions that the total number of passengers carried by buses in 1927 was over 2,500,000,000. Of these 2,210,000,000 were transported by regular bus transportation carriers. The total investment in bus transportation, including rolling stock, terminals, and garages, is approximately \$500,000,000, and the gross revenue of common carrier bus lines in 1927 was nearly \$313,000,000. This indicates that bus transportation has become an extremely large and important means of travel.

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Maybe there is something in psychology and habits of mind after all.



## AMERICAN STANDARDS ASSOCIATION

The name of the American Engineering Standards Committee, which has been the final court of approval of national standardization work in this country, will be changed to the American Standards Association. The headquarters will continue to be located at 29 W. 39th St., New York City. The reconstructed body will include a federation of national organizations. In this way trade associations interested in standardization may more readily join in the standardization movement. The technical work of approving standards will be handled by a Standards Council and the administrative and financial responsibility will be in the hands of a board of directors composed of twelve industrial executives. The Standards Council will be composed of not more than three representatives of each of the member bodies, each representative serving for a period of three years.

The underlying principles of the American Engineering Standards Committee will remain unchanged. The basic functions remain completely in the hands of the representatives of the member bodies. The individual members, whether of the board of directors or of the Standards Council, are appointed or nominated by the member bodies. The name American Standards Association is being adopted as more accurately descriptive of the reorganized association.

\* \* \*

## THE WORLD'S LARGEST NAVAL VESSEL

The U. S. S. *Lexington*, the largest and highest-powered naval vessel in the world, is just about completed. This ship belongs to the group of electrically driven vessels which includes the *Maryland*, *West Virginia*, and *Saratoga*. The *Lexington*, like the *Saratoga*, is an airplane carrier. Originally, it was intended for a battle cruiser, but due to the modification of the naval program, the ship was converted into an airplane carrier. The flying deck has an unbroken flying surface 900 feet long. Special provision is made on the deck floor whereby landing planes can be stopped within a distance of a few hundred feet. The *Lexington* will be propelled by electric machinery developing 180,000 horsepower. The vessel is the longest naval ship in the world, being 874 feet long, with a beam of 105 feet. Her displacement is 33,000 tons. The ship contains more than 600 separate "rooms," each of which is supplied with a loud speaker, so that from any one of several central stations about the ship, any person on board may be immediately reached. It is stated that the *Lexington*, when completely equipped for service, will have cost the government of the United States \$45,000,000.

\* \* \*

The railways of the United States in 1927 bought 6,125,000 tons of steel. The building industries used 7,000,000 tons.

## TAPER-BORING CAST-IRON CYLINDERS

The taper-boring of large cast-iron cylinders like the one shown at A, Fig. 1, is an interesting example of the adaptation of a standard type machine tool to a rather unusual production job. This work is done by the Shaw Crane-Putnam Machine Co., Inc., at the Putnam Machine Co. Works, Fitchburg, Mass. The cylinder has a wall thickness of 9/16 inch, and it is required to be taper-bored to a diameter of 21 3/4 inches at the large end, tapering to a diameter of 21 5/8 inches at the smaller end. The length of the tapered bore is 6 feet. Two cuts are taken—a roughing cut with a feed of 3/16 inch per revolution of the boring-bar, and a finishing cut at a feed of 3/8 inch per revolution, using a finish-boring tool. The floor-to-floor machining time, using the feeds mentioned, is five hours. The

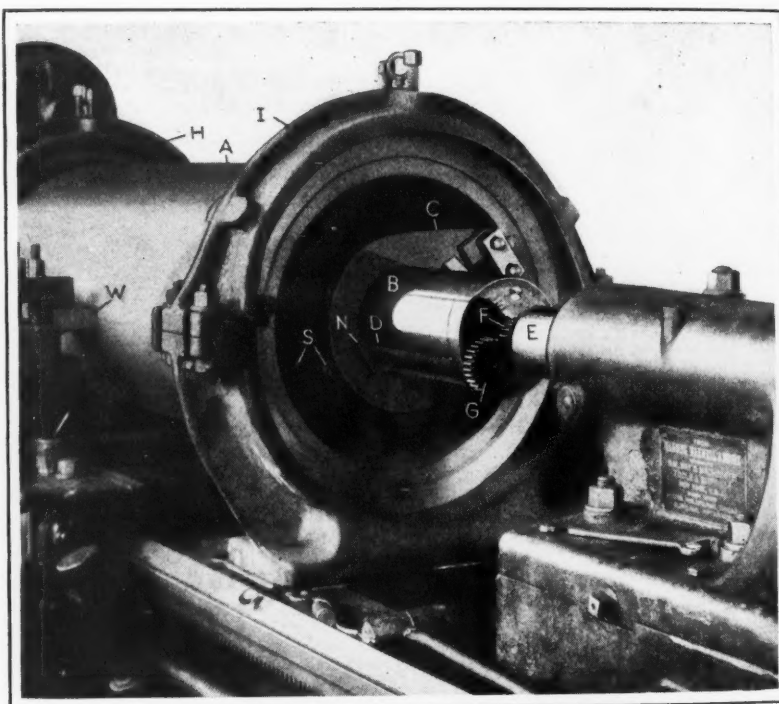


Fig. 1. Geared-head Lathe Equipped for Taper-boring Large Cast-iron Cylinders

work is handled on a Putnam 36-inch geared-head lathe.

The special tool equipment is simple, consisting primarily of a boring-bar *B*, bolted to the lathe faceplate, a tool-head *C* fed along the boring-bar by screw *D*, a tailstock center *E* provided with a fixed gear *F* which meshes with a gear *G* on the feed-screw *D* of the boring-bar, and two work-rests *H* and *I* mounted on the lathe ways.

The taper of 1/8 inch in six feet is obtained by having the flanged end of the boring-bar bolted to the faceplate in an off center position, and the outer end supported on the tailstock center *E*, which is in line with the center of the lathe spindle. The boring-bar is thus mounted at a slight angle with the faceplate, which causes the tool to bore the work to the required taper. The angle *T* between the axes *X-X* and *Y-Y*, as indicated in Fig. 2, is somewhat exaggerated in order to show more clearly the exact conditions.

In making the boring-bar, the body was first turned to size on centers, with the work rotating

about the center line  $X-X$ . After completing this operation, a new offset center was made on the flanged end, the locating boss  $K$  turned, and the flange faced with the work rotating about the axis  $Y-X$ . The boss  $K$  provides an accurate means of locating the boring-bar on the faceplate.

Referring to Fig. 1, the work is held stationary in the rests  $H$  and  $I$ , the upper half-members of which serve as clamps. Two centers  $E$  and two gears  $F$  and  $G$ , which give a feed of  $3/16$  inch per revolution of the boring-bar, is used for the roughing cut. The other set, giving a feed of  $3/8$  inch per revolution, is used for the finishing cut.

The half-nut  $N$ , which is secured to the boring head by cap-screws  $S$ , serves as a driving key as well as a feed nut. By simply removing screws  $S$ , the boring head is allowed to slide freely on the

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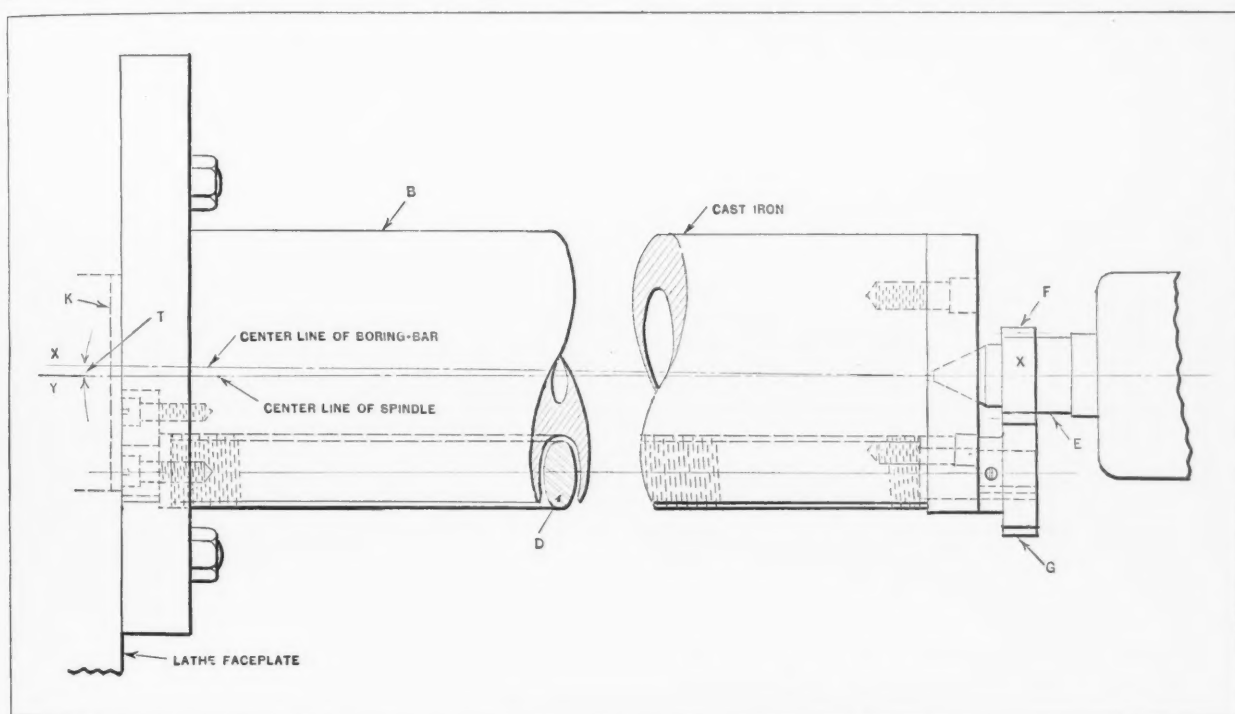


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# A New Linear Dividing Machine

**S**CALES up to 40 inches or 1 meter in length can be automatically graduated in practically any combination of rulings, either in the inch or metric system, with a linear dividing machine recently brought out by the Gaertner Scientific Corporation, 1201 Wrightwood Ave., Chicago, Ill. Graduations can be produced on flat, beveled or curved surfaces, varying from the finest microscopic rulings made with a diamond point, to the heavier graduations required on commercial scales. The machine is driven by a 1/4-horsepower motor running at 1200 revolutions per minute; provision is made for three different speeds of operation. At the highest speed, about 30 lines can be ruled per minute. Microscopes adjustable along the rear of the bed facilitate accurate settings.

Power is delivered from the motor to pulley A, Figs. 2 and 4, by means of a round belt, and then through worm-gearing to the driving shaft B, Fig. 4, which, in turn, transmits the power to the different mechanisms. The worm is mounted on the same shaft as pulley A, a bearing of this shaft being hinged to permit engaging or disengaging the worm with worm-wheel C, Fig. 2, by means of a handle that is conveniently located.

## How the Spacing Mechanism Functions

On driving shaft B there is mounted a disk D, Fig. 2, to which a variable lever arm E is permanently attached. This lever arm is adjustable for regulating the amount of movement imparted to the spacing mechanism. The lever arm is provided with a scale to facilitate setting the lever fulcrum to different radii. Through gears this motion is transmitted to the spacing mechanism seen in Fig. 3 which consists of a ratchet wheel G and two disks H and J. The ratchet wheel, two of which are furnished, is fastened to the lead-screw F. Disk H is mounted independently of the lead-screw, and together with disk J regulates the amount of rotation imparted to the lead-screw. A pawl K attached to disk H engages with the ratchet wheel when this disk is rotated clockwise and is relieved when the disk is turned in the opposite direction. On one side of disk H there is a hardened steel stop permanently attached, while another stop mounted on disk J may be rotated with relation to disk H.

The lead-screw is cut of a high-carbon steel and has a thread the sides of which form an angle of

50 degrees. The lead-screw nut is made of bronze and is of sufficient length to give long service. It is made in halves which are adjustable to compensate for wear. The two nut parts are held firmly together by means of four springs which pull against a similar number of adjustable contact points. The nut is released from the screw by turning a convenient lever W, Fig. 3. When the nut is released it rests in a bronze cradle attached to the end of the carriage that carries a thrust plate which the nut bears against. Two hardened steel points attached to the nut form the contact. A hinged plate between the carriage and the contact points equalizes the pressure of the points.

The same hinged plate serves in connection with a lever system for making corrections for the total length of the screw to suit differences in temperature. A steel straightedge is located below the screw and one end of a lever attached to the nut bears against this straightedge. If the straightedge is adjusted parallel to the screw, no correction takes place, but if the straightedge is inclined, the lever will transmit a motion to the carriage independent of the screw. This motion

may retard or advance the carriage, depending upon the direction in which the straightedge is inclined. The inclination of the straightedge is accomplished by means of a gear sector and pinion, a graduated scale showing the inclination.

Any small progressive errors in the screw are corrected in the usual manner by means of a guide bar at the front of the machine against which the nut guide bears. Periodic errors in the screw have been corrected to very close limits.

## Operation of the Tracing Mechanism

The engraving tool is actuated by a tracing mechanism which is supported on a bracket, as shown in Fig. 4, upon which it can be shifted back and forth as desired, and raised or lowered by turning handwheel L, to actuate a vertical screw. Pressure is applied to the engraving tool by means of a coil spring contained in housing M, Fig. 5, the pressure being adjustable by turning the nut at the top of this housing. The tool is mounted in socket N. Four different springs are used according to the fineness of lines desired. In ruling lines of microscopic fineness, the spring is removed and the weight of the tool and supporting lever is then counterbalanced by a light spring placed on the screw which projects from housing M. This pres-

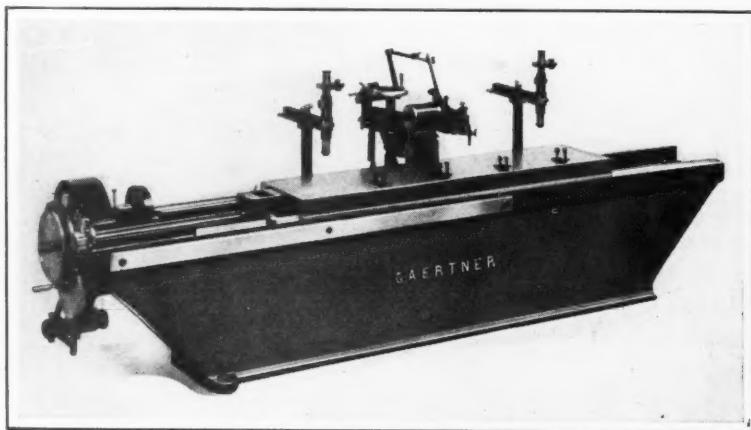


Fig. 1. Gaertner Linear Dividing Machine

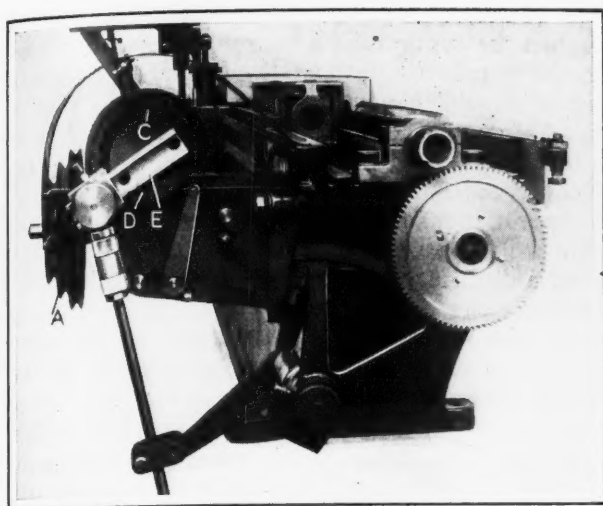


Fig. 2. Mechanism which Transmits Power to the Spacing Mechanism Shown in Fig. 3

sure is adjustable by means of the nut on the projecting screw. Rocker arm *O* raises and lowers the tool, this rocker arm being operated at the beginning and end of each stroke by the excess motion of a rack mounted on slide *T*. Set-screws *P* regulate the length of lines produced by contacting with drum *Q* and govern the type of ruling, as described in the article "Gaertner Circular Dividing Machine," published in July, 1928, *MACHINERY*. Five drums are furnished for different rulings.

Motion of lever arm *R*, Fig. 4, for actuating the tracing mechanism, is delivered through a friction clutch fastened on lever *S* to a spur gear which engages the rack mounted on slide *T*. The rack is not rigidly attached to the slide but has the small lengthwise play which is utilized in operating rocker arm *O* to raise or lower the engraving tool. The tracing mechanism permits the ruling of lines up to 1 inch in length. It is mounted on a swivel so that it may be positioned at any angle in refer-

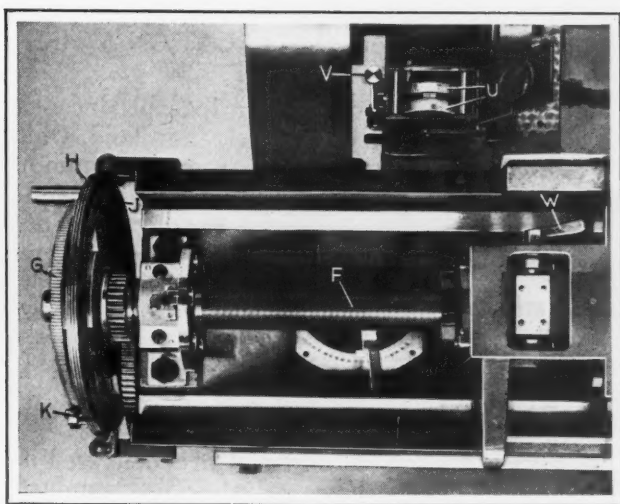


Fig. 3. Spacing Mechanism which Governs the Movements of the Carriage Between the Tracing Tool Strokes

ence to the scale up to 30 degrees plus or minus from the horizontal plane.

#### Automatic Stop Mechanism

Fig. 3 at *U* shows an automatic stop mechanism which consists of two graduated wheels enclosed in a housing. Both wheels are divided into one hundred parts, each division of the one wheel being equivalent to one line ruled, while each division of the other is equivalent to 100 lines ruled. Both wheels carry a hardened steel disk with a notch that engages handle *V* when the wheels are in the neutral position. These wheels are rotated by a pawl- and ratchet-wheel system operated by a connecting arm which receives motion from a cam on the main shaft. When the number of graduations are produced for which the wheels have been set, handle *V* stops the machine. The wheels provide for stopping the machine when any desired number of lines from 1 to 10,000 have been ruled.

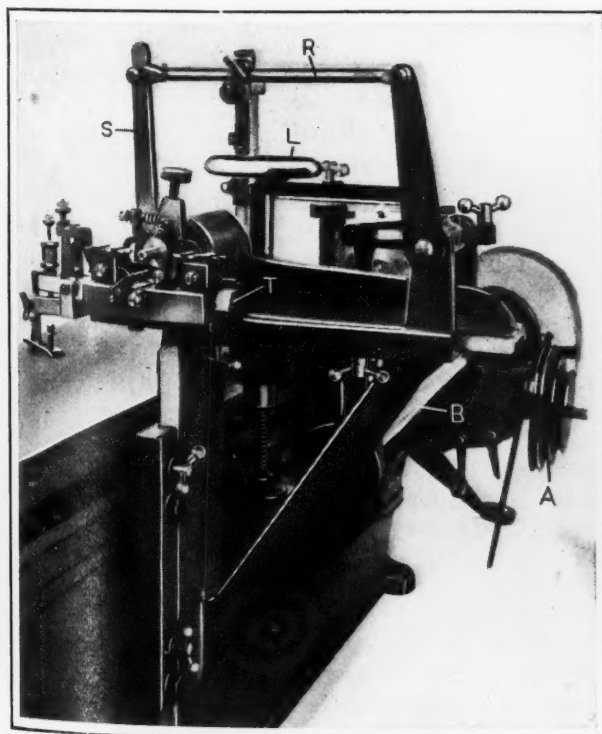


Fig. 4. Tracing Mechanism which Carries the Tool Back and Forth across the Work

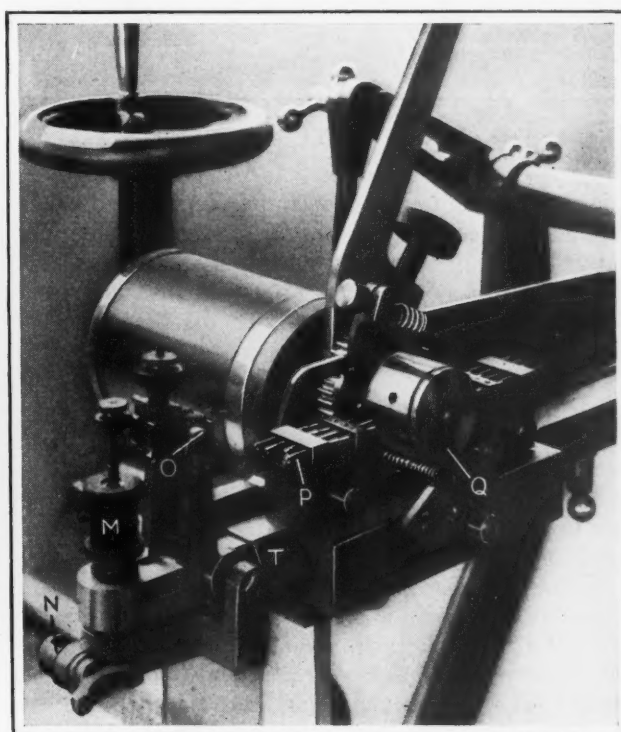


Fig. 5. Arrangement of Mechanism which Governs the Length of the Tracing Tool Strokes



## TUMBLING BARREL INSTALLATION WHICH SAVES FLOOR SPACE

Wrenches and other drop-forgings produced at the plant of the Vlcek Tool Co., Cleveland, Ohio, are carried by conveyors direct from the trimming presses to a storage room on the second floor of the trimming shop. Here the forgings are discharged into large metal boxes, such as seen in the background of Fig. 1, in which they can be conveniently stored until they are required at the coining presses. The latter straighten the forgings and squeeze such surfaces as the ends of wrenches to the required thickness within a few thousandths of an inch.

Before the trimmed forgings are delivered to the coining presses, however, they are tumbled.

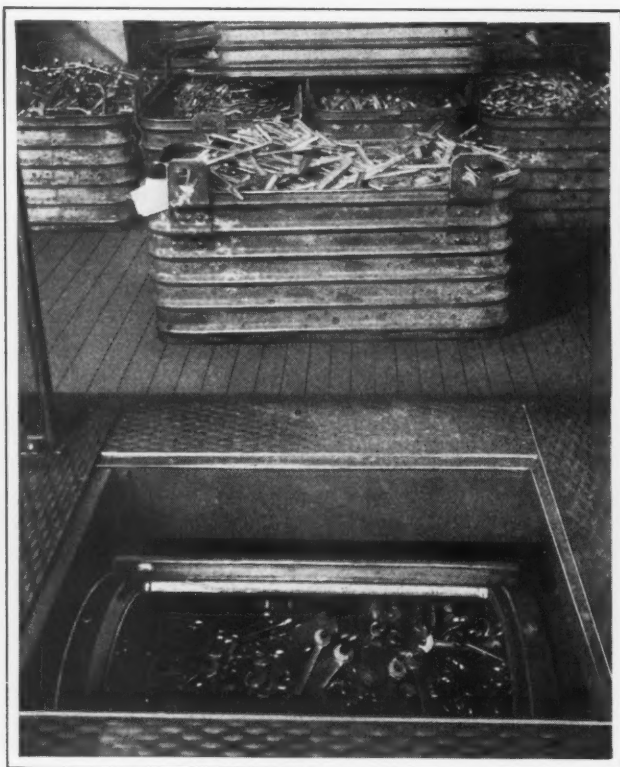


Fig. 1. One of Four Tumbling Barrels Installed Beneath the Floor So as to Save Space

This is accomplished by four tumbling barrels which have been installed on a platform suspended from the ceiling of the trimming shop. Placing the barrels in this position has resulted in a considerable saving of floor space. Each of the barrels is accessible by raising a sheet-metal plate on the storage-room floor, as may be seen from Fig. 1, in which the tumbling barrel is shown with the cover removed.

It is an easy matter to load a tumbling barrel by bringing one of the metal boxes filled with forgings to the barrel by means of an overhead crane and then dumping it. The barrels are rotated to bring the lid uppermost by revolving a crank. After a barrel has been loaded, the lid is clamped in place, the floor plate returned to position, and the motor drive to the barrel started. All four barrels are entirely out of the way, and the floor plates above them can be used for storage space, if necessary, until the time for reloading the barrels again arrives.

When the contents of a barrel have been tumbled for the required length of time, a metal box on a skid is pushed beneath the chute seen in Fig. 2, this chute being in the trimming press department on the floor below the storage room. Then the lid or cover of the tumbling barrel is removed, and the barrel turned by means of the hand-crank to allow the parts to slide from the barrel, down the chute, and into the metal box. The contents of all four tumbling barrels are disposed of through one chute. This chute is adjacent to the coining presses, so that the metal boxes loaded with parts can be quickly moved to those machines.

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An interesting labor-saving machine has recently been put on the market by the Duplex Automatic

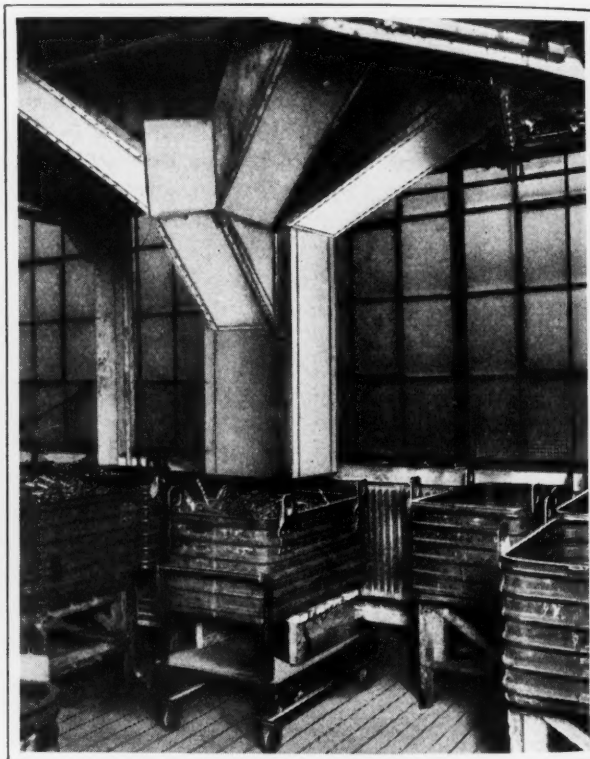


Fig. 2. Chute Through which Contents of the Tumbling Barrels are Conveniently Discharged

Nailer Co., Logansport, Ind. This machine, which is pneumatically operated, both holds and drives nails automatically. It is made in several sizes to handle nails and spikes of different kinds. So far the equipment has been constructed for driving nails vertically only, but it is stated that a type of machine is being designed which will be able to drive nails horizontally.

\* \* \*

According to a statement published by the Industrial Machinery Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., the United States exported in 1927 more than \$183,000,000 worth of industrial machinery. Canada was the leading customer of the United States, followed by the United Kingdom, Mexico, Cuba, Venezuela, Argentina, Germany, Australia, Japan, and Soviet Russia, in the order mentioned. Of the machinery exported, the metal-working machinery was valued at \$25,379,000.

# New Machinery and Tools

The Complete Monthly Record of New Metal-working Machinery

## GRANT DOUBLE-END AUTOMATIC CHAMFERING AND THREADING MACHINE.

Chamfering and threading of tubes from 1/2 to 2 1/4 inches in diameter and from 7 inches to 6 feet in length can be performed in a large-sized automatic machine recently brought out by the Grant Mfg. & Machine Co., N. W. Station, Bridgeport, Conn. The tubes are fed mechanically from a magazine into the machining position and the two ends are simultaneously chamfered, faced, burred, or threaded, as the case may be, by tools held in chucks or heads moved to and from the work.

Power for driving the machine is derived from a 5-horsepower motor mounted under the left-hand end of the bed pan as may be seen in Fig. 1. A silent chain transmits the power from the motor pinion to a gear mounted on one end of a stub shaft on which a speed change-gear is also mounted. The latter meshes with a second change-gear on the left-hand end of a driving shaft that extends the entire length of the bed along the rear side. Each head spindle is driven from this drive shaft through herringbone gears, the first gear in both trains being mounted on a sleeve keyed to the drive shaft but which slides along this shaft with the head movements. The gears in both trains revolve constantly in oil.

The top of the bed has two flat scraped ways on which the heads are reciprocated. Felt wipers attached to the heads protect these ways. The heads are also equipped with gibs which are adjustable to compensate for wear. Coolant is fed to the tools through the center of each spindle by a pump seen near the far end of the machine in Fig. 2.

From the right-hand end of the driving shaft, power is delivered through a set of feed change-gears to a shaft which runs along the front of the bed. In the drive to this shaft there is a safety clutch which slips and thus guards the machine against damage should the work become jammed, etc. Two drum cams A, Fig. 3, for controlling the forward and backward horizontal movements of the spindle heads are mounted on this front shaft. They actuate these heads by contacting with rollers attached to the underside of the heads. These cams can be conveniently adjusted along the shaft to suit the different locations of the spindle heads as required by the different lengths of work handled. Various head strokes are obtainable by simply changing the cam blocks. Minute lengthwise adjustments of the cams relative to the spindle heads are provided for by rotating nuts at the ends of the cams.

The work-feeding and clamping mechanisms are mounted on brackets which also span both ways of the bed. Fastened to these brackets are several plates which comprise the magazine for holding the work tubes until they are fed into the machining position. The brackets, with the magazine parts and the feeding and clamping mechanisms, are also readily adjustable along the bed to suit the length of work.

During an operation, each end of the tube being machined is firmly held between fixed and movable V-block jaws. When the spindle heads recede upon completion of the cuts, each movable jaw is pulled toward the front of the machine by a bellcrank lever B (see Fig. 3) which is actuated by cam C.

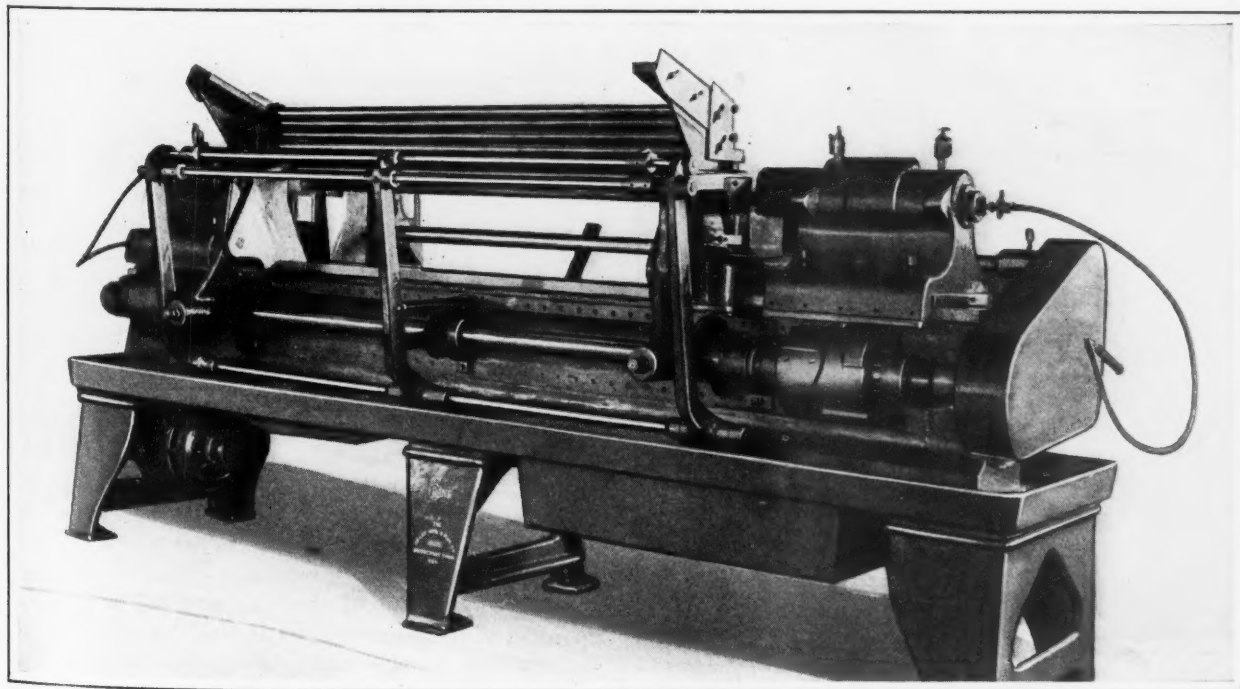


Fig. 1. Grant Double-end Automatic Chamfering and Threading Machine



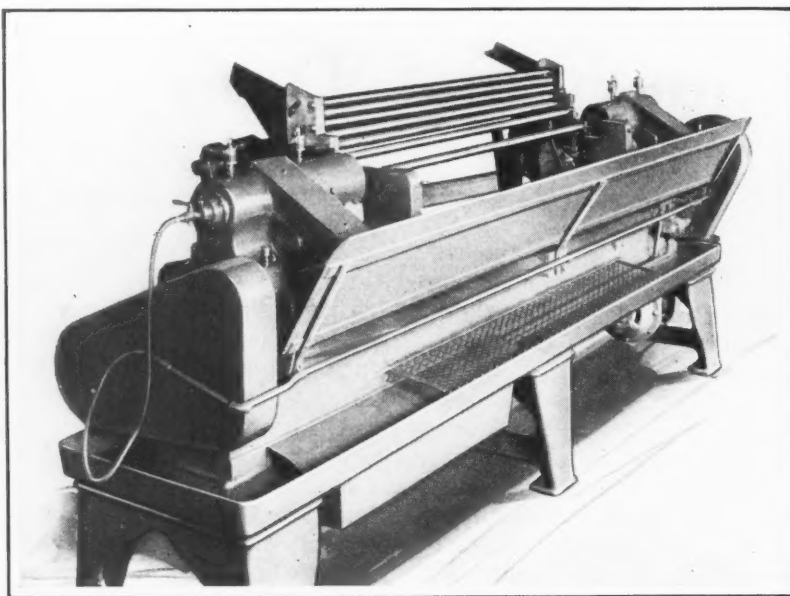


Fig. 2. View of Threading and Chamfering Machine Showing how the Work is Held

Both of these cams are mounted on the same shaft as the drum cams which actuate the spindle heads. As the movable jaw is pulled forward, the finished tube falls from the jaws into the bed of the machine and rolls down an incline into a receptacle placed at the rear.

At the same time, three arms *D* mounted on a rod at the front of the machine, are pulled toward the machine through the action of springs. Plunger pins connected to the ends of rod *E* which joins the three arms at the upper ends, are by this movement pushed against the lower tube in the magazine, causing this tube to roll forward and drop into a pocket of feed-bar *F*; there is one of these feed-bars at each end of the machine. With the continued backward movement of arms *D*, the two feed-bars carry the tube approximately into line with the head spindles where the bars hold the tube stationary until cams *C* cause levers *B* to swing backward and bring the movable jaws in firm contact against the tube. As the heads advance toward the work, a cam in the middle of the front shaft causes arms *D* to swing forward and withdraw bars *F* from interference with the tools. In addition

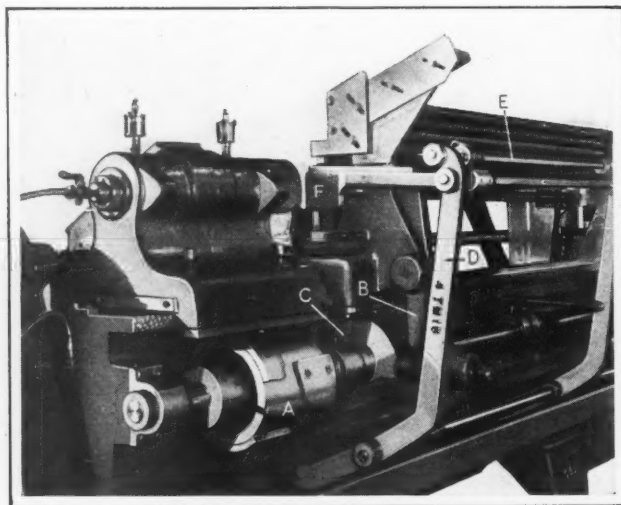


Fig. 3. Mechanism which Actuates Each Spindle Head and the Work-feeding and Clamping Mechanism at One End of the Machine

tion to feeding a tube forward in each cycle of the machine, the plunger pins attached to rod *E* prevent the tubes in the magazine from rolling downward during an operation. Ejectors insure that the tubes drop from the jaws when the operation is completed.

By means of the change-gears at the right-hand end of the bed, the machine cycle can be lengthened or shortened to suit each particular job. In chamfering tubes 1 1/2 inches in diameter and 6 feet in length, the cycle is arranged to give a production of 12 tubes per minute.

Spindle speeds to suit each operation are also conveniently obtainable by substituting the change-gears at the left-hand end of the machine. The machine is approximately 11 feet long and weighs about 5 tons.

#### NILES RAILROAD-SHOP MACHINES

Latest additions to the line of machine tools built primarily for railroad-shop use by the Niles Tool Works Co., Division of the Niles-Bement-Pond Co., Hamilton, Ohio, include a two-spindle locomotive connecting-rod boring machine and a 100-ton hydraulic bushing press. Double-quartering and crankpin turning attachments have also been developed for the 90-inch locomotive axle-journal turning lathe made by the concern; the No. 4 car-wheel lathe is now regularly equipped for handling wheel sets having roller-bearing journals; and a boring-bar attachment for machining locomotive-cylinder bushings has recently been supplied on a "Time Saver" lathe.

The rod boring machine, Fig. 1, is adaptable to all boring and facing operations on locomotive connecting-rods. Each spindle is driven by a 15-horsepower variable-speed motor giving spindle speeds ranging from 8 to 140 revolutions per minute. The motors are mounted on the back of the cross-rail, one at each end, and are connected to the corresponding spindles through gear-boxes. The final drive to each spindle is through worm-gearing.

The spindles have a vertical travel of 22 inches and, in addition to a rapid hand-adjustment, are provided with a fine hand-feed and six automatic geared feeds ranging from 0.005 to 0.155 inch per revolution. Adjustment of the spindle saddles along the cross-rail is accomplished by a rack-and-pinion mechanism. There is a minimum distance between spindle centers of 36 inches and a maximum distance of 14 feet 2 inches. The maximum distance from the top of the table to the lower ends of the spindles is 30 inches.

A lower rail-support is bolted to the housings for steadying the ends of the spindles when using trepanning cutters or box-tools. The spindle guides may be moved out of the way and the rail elevated so as not to interfere with the use of pilot-bars. In addition to the main table, two movable work tables are provided having bushed holes which are used in connection with boring-bars having pilots

at their lower ends. For machining bosses on certain types of rods, each spindle is equipped with a facing head having a pilot-bar which is guided by the bushing in the corresponding movable work table. The facing heads have star feeds. Two independently driven pumps circulate cutting fluid.

The 100-ton hydraulic bushing press is of a special design equipped with a sliding table which is movable along the base to facilitate pressing bushings in and out of driving boxes. As seen in Fig. 2, this sliding table is traversed on the baseplate by a separate 1-horsepower motor. On the sliding table there is a heavy cast-iron block with a U-shaped opening which supports the driving boxes during the operation; when desired, this block can be removed. It has three pins at the bottom which engage corresponding holes in the top of the table to provide for accurately centering the block under the press ram. The table driving motor is reversible and has a push-button control with suitable limit switches for preventing over-travel of the table in either direction.

A pump of the two-plunger type is provided for this hydraulic press. The pump is driven by a 7 1/2-horsepower motor which is geared directly to it. The machine has a capacity for pressing in or out, bushings 20 inches long. There is a width between the tension bars of 34 inches, and the ram stroke is 24 inches. The maximum height between the top of the sliding table and the ram is 43 1/2 inches.

Changes made in the tool-rests and bed of the No. 4 car-wheel lathe make the machine equally adaptable to the chucking of wheel-sets having either roller or plain journal bearings. Inasmuch as it is impractical to remove the roller bearing housings from journals, the wheels cannot be chucked by split bushings. They are mounted on centers in the sliding spindles, and it is necessary to only remove the end cover plates of the housings to expose the centers in the axle.

This method of chucking requires some lateral adjustment of the tool-rests along the bed to bring the cutting tools opposite the wheel-treads, owing to the greater distance required between the faceplates when axles are held on centers. Each tool-rest of the machine is, therefore, mounted on a sub-base, as shown in Fig. 3. These sub-bases have a small amount of lateral adjustment through rack-and-pinion mechanisms.

Fig. 4 shows the "Time Saver" lathe equipped with the boring-bar attachment, as previously mentioned, this attachment being employed for turning, boring and recessing large bushings of three-bore locomotive cylinders. This equipment was furnished to a foreign manufacturer. A bracket for supporting the boring-bar is bolted across the wings of the carriage. The boring-bar has an outer support, and a pilot-bar is carried in a bushing on the spindle nose. The end of the bar is fitted with a key to which a boring-head is secured. A large center-rest constitutes part of the equipment.

The bushings machined in this lathe are about 40 inches long, have an outside diameter of 27 1/2

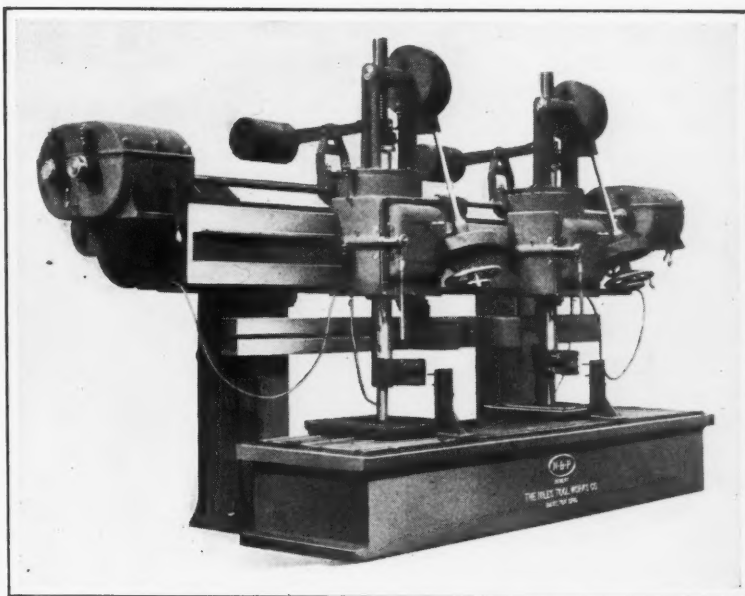


Fig. 1. Niles Locomotive Connecting-rod Boring Machine

inches and have a bore of 25 1/2 inches. They are cast with a flange to facilitate chucking on the faceplate. After the chucking, a light cut is taken on the outside, to provide a bearing for the center-rest. The casting is then ready for the boring operation. After the boring has been completed, the bushing is mounted on an arbor between centers and the excess length of the bushing and flange cut off, the outside turned, both ends faced and recesses in both ends machined.

Figs. 5 and 6 show close-up views of the 90-inch locomotive axle-journal turning lathe equipped for double-quartering and crankpin turning, in addition to turning the inside and outside of the journals. The arrangement for journal turning and quartering has been previously described, and this

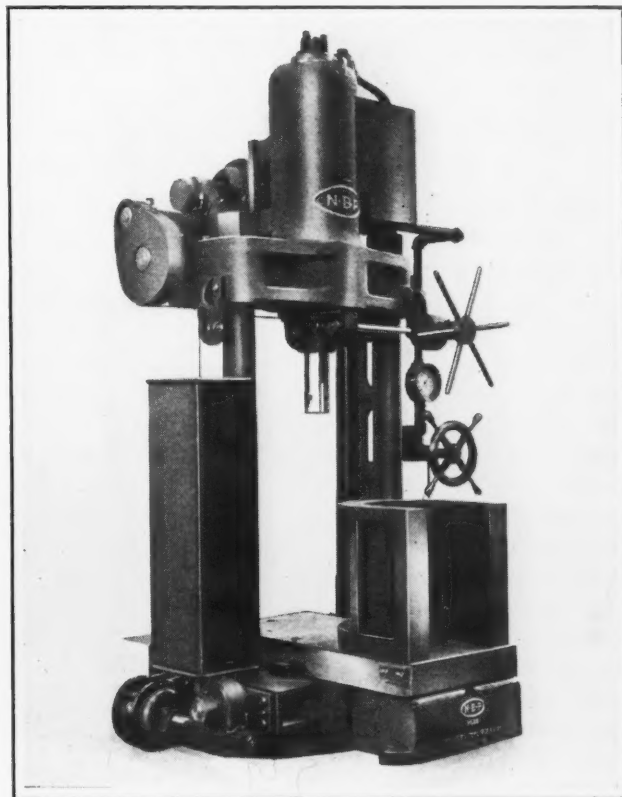


Fig. 2. Hydraulic Press of 100 Tons Capacity for Pressing Driving-box Brasses In or Out



article will, therefore, deal only with the application of the crankpin turning attachments. The crank-pin heads are of the box-tool type and are mounted on heavy bases bolted to the bed. The right-hand head is mounted on the base to which the outside journal rest is attached, while the left-hand head is on an independent base adjacent to the faceplate.

These heads receive their rotation and lateral adjustment from the quartering-attachment spindles. They will turn crankpins from 7

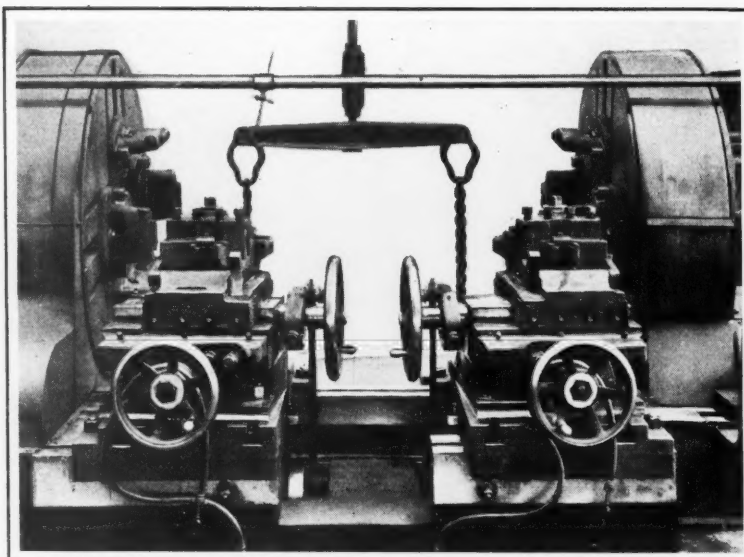


Fig. 3. Equipment on Car-wheel Lathe which Permits Chucking Wheel Sets with Either Roller or Plain Journal Bearings

hand attachment is raised and tilted 30 degrees by means of a filler block. This filler block can be easily detached to bring the quartering frame back into position for wheels with 90-degree leads. To support the boring-bar for quartering and the crankpin head for pin-turning, additional brackets of suitable height are supplied.

Both journals of center-crank axles for three-cylinder locomotives may be turned at one setting by using the special rest shown in Fig. 6. This rest has narrow slides and

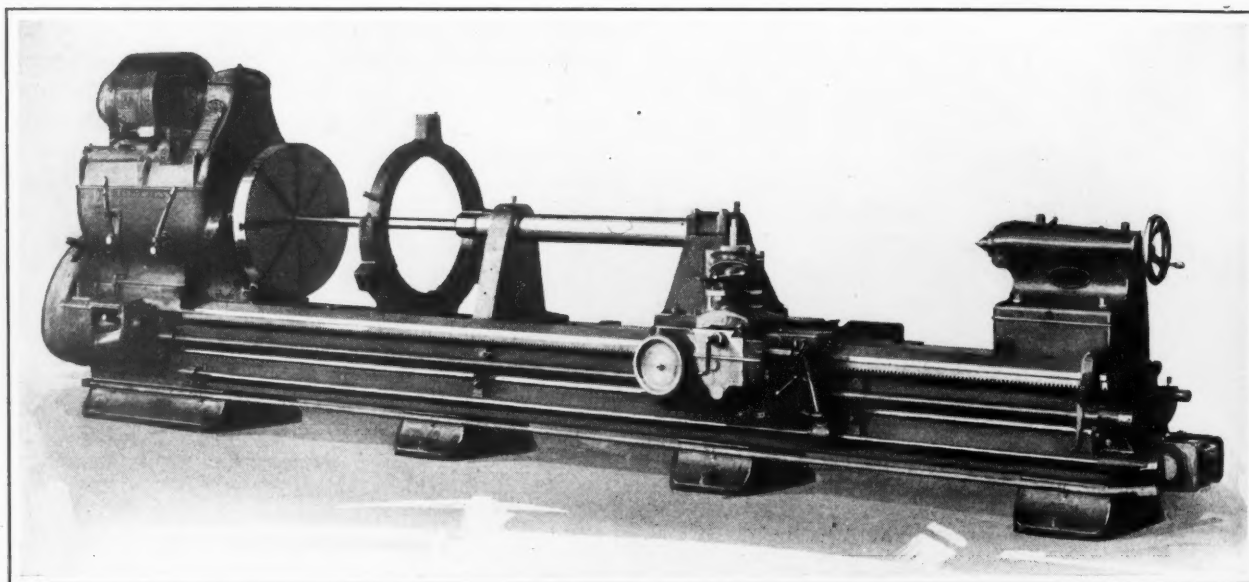


Fig. 4. "Time Saver" Lathe equipped for Turning, Boring and Recessing Locomotive Cylinder Bushings

to 12 inches in diameter and up to maximum length. Burnishing tools having shanks which fit the tool-slots in the crankpin head tool-holders, are regularly furnished for obtaining the desired finish after the turning operation.

Fig. 5 shows the machine arranged for handling only wheel-sets with 90-degree leads. The increased use of three-cylinder locomotives with cranks 120 degrees apart has made it necessary to provide for these wheel-sets as well. When it is desired to double-quarter or turn the crankpins of such wheel-sets, the right-

can be quickly interchanged with the regular rest. It has a power longitudinal feed and is fed cross-wise by hand.

Improvements recently incorporated in the machine include steel wearing plates on the bed under the sliding heads.

These plates are renewable and constitute a means of preserving alignment between the heads. A brass-plate is now attached to the faceplate alongside of the balance indicator pointer, on which may be marked the balancing positions of wheel-sets for various classes of engines. This serves

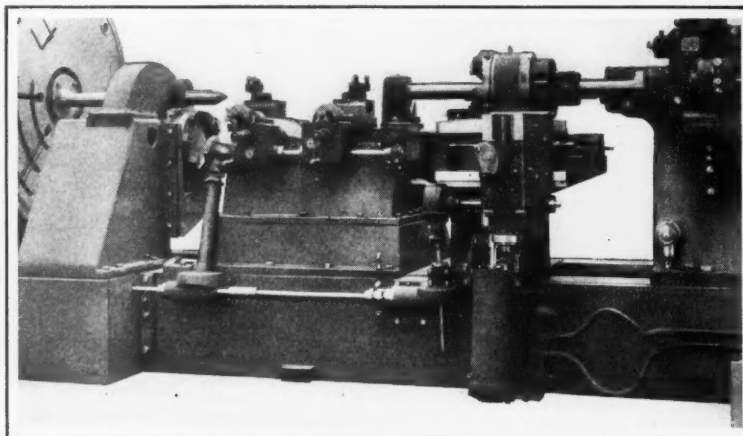


Fig. 5. Locomotive Axle-journal Turning Lathe Equipped for Double-quartering and Crankpin Turning

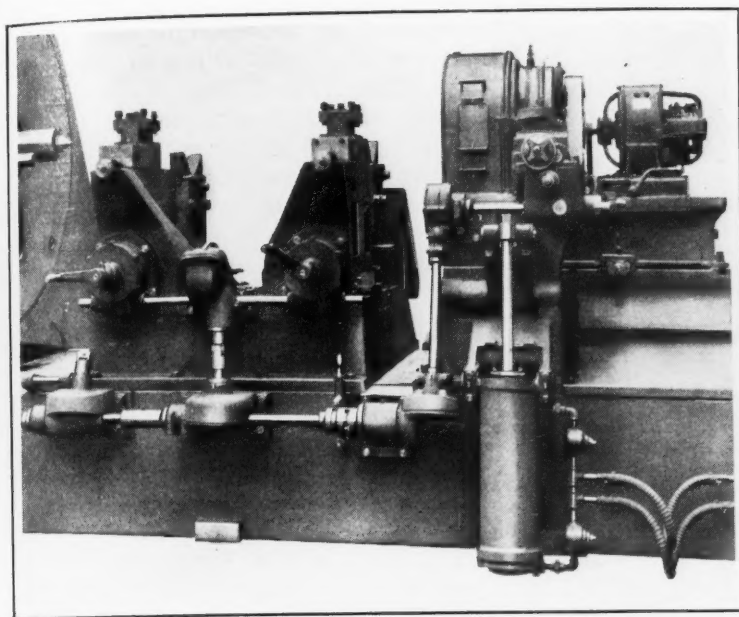


Fig. 6. Special Rest which Permits Turning at One Setting Both Journals of Center-crank Axles for Three-cylinder Locomotives

as a permanent record and enables the operator to quickly set the counter-weight on wheels for engines of the same types.

#### CLEVELAND ARC-WELDED CRANE

A new design of overhead traveling crane in which the bridge girders, end trucks and trolley are constructed by arc welding, is a recent development of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. A 5-ton crane of the I-beam girder type having a span of 38 feet 9 1/4 inches, has recently been built in which each girder is reinforced throughout its length by means of angle-irons arc-welded to the I-beam sections. The girders are attached to the end trucks by a notched or shoulder construction designed to prevent "weaving."

The end trucks themselves are built up of two standard channel-iron sections joined by arc welding. Each trolley frame is made of a standard channel iron with arc-welded braces under the bearing points. Gear guards are arc-welded, as

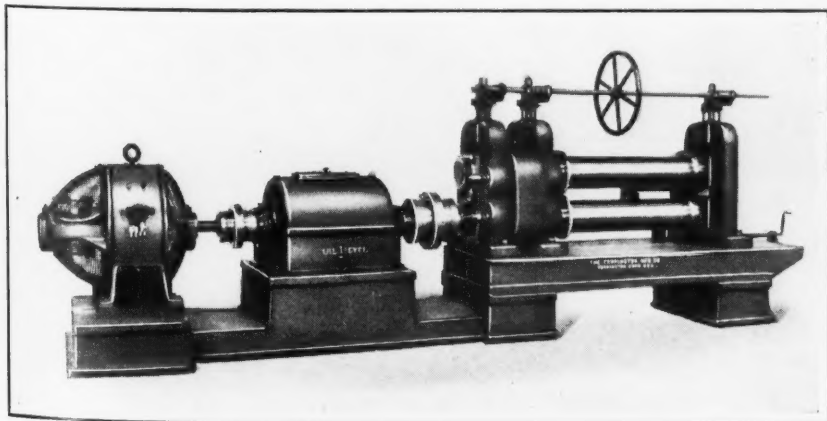


Fig. 1. Torrington Slitting Machine which may be Used in Combination with the Machine Shown in Fig. 2, or Separately

are also a hand-rail on the foot-bridge and bearing supports for the bridge drive shafts. All welding on this crane was done with machines furnished by the Lincoln Electric Co., Cleveland, Ohio.

#### TORRINGTON SLITTING AND COILING MACHINE

Slitting and coiling machines recently developed by the Torrington Mfg. Co., Torrington, Conn., for use either in combination with each other or separately, are shown in Figs. 1 and 2, respectively. When these machines are used together, wide strips of metal can be slit and coiled in a single operation without necessitating intermediate handling.

The slitting machine has capacity for metal sheets up to 42 inches in trimmed width and up to 1/4 inch thick. It is of the three-housing type, the outer housing being withdrawn on an extension of the bed to permit changing cutter blades and spacing collars. The arbors are 6 3/4 inches in diameter and take slitter blades 12 inches in diameter by 1

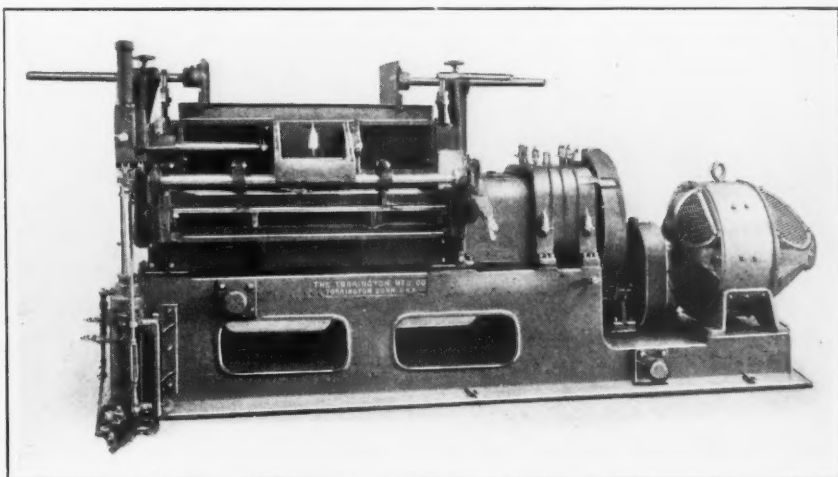


Fig. 2. Coiling Machine Equipped with an Air-operated Coil Ejector

inch thick. The machine is driven by a 50-horsepower motor. Interposed between the motor and the machine is a herringbone-gear speed reducer, the gears of which are enclosed in an oil-tight case.

The cutter-arbor pinions are also of the herringbone type and are totally enclosed in a grease-tight case. Vertical adjustment of the top arbor is accomplished by operating the handwheel to actuate lifting screws through worm-gears. Both ends of the arbor are raised in unison by means of this mechanism. Provision is also made for lateral adjustment of the top arbor in relation to the bottom one.

The coiling machine is of the usual three-roll type equipped with pinch or feed-rolls. Its use enables the immediate removal of the coil without the necessity of stripping it from a block. An air-operated coil-ejector, necessitated by the weight of the coils, is provided.



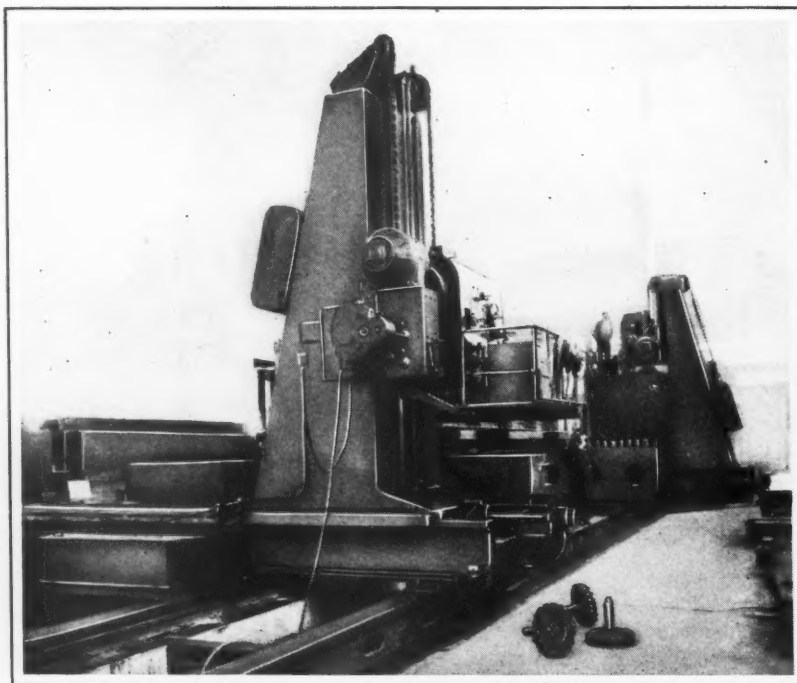


Fig. 1. Sellers Special Boring, Drilling and Milling Machine for Finishing Ends of Bridge Section, etc.

#### SELLERS SPECIAL BORING, DRILLING AND MILLING MACHINE

In the fabrication of large built-up structural members for towers and bridges, it is necessary to finish the abutting ends of these sections for joining purposes. William Sellers & Co., Inc., Philadelphia, Pa., has recently built a special machine designed to finish the ends of such structures accurately and quickly. This machine was furnished to the McClintic-Marshall Construction Co., Pottstown, Pa. As may be seen in the accompanying

illustration, the machine consists of two milling units which are mounted on a bed 80 feet long. Each milling unit comprises a Sellers floor-type boring, drilling and milling machine.

As shown in Fig. 2, one milling unit is mounted on a rotary base at one end of the long bed in such a manner that the unit can be swiveled by power in either direction to any angle up to 45 degrees. Therefore, structural members can be finished at an angle, as well as square. The second milling unit is mounted on a sub-base, as shown in Fig. 1, which is adjustable longitudinally by power along the bed. This unit can be conveniently set any required distance from the unit on the rotary base, to provide for finishing both ends of sections with one setting of the work.

Each milling unit carries with it a slotted work-table, on which the structural sections to be machined are supported and fastened. There is an intermediate support in the form

of a four-wheel truck, which may be seen clearly in Fig. 2. This truck eliminates any sag that might otherwise occur in members being machined. Both milling units have the driving motor mounted directly on the head and full control is within easy reach of an operator standing on the platform. As these units are provided with a wide range of boring and drilling speeds and feeds, holes can be machined in the ends of structural sections at the same setting of the work as a milling operation is performed.

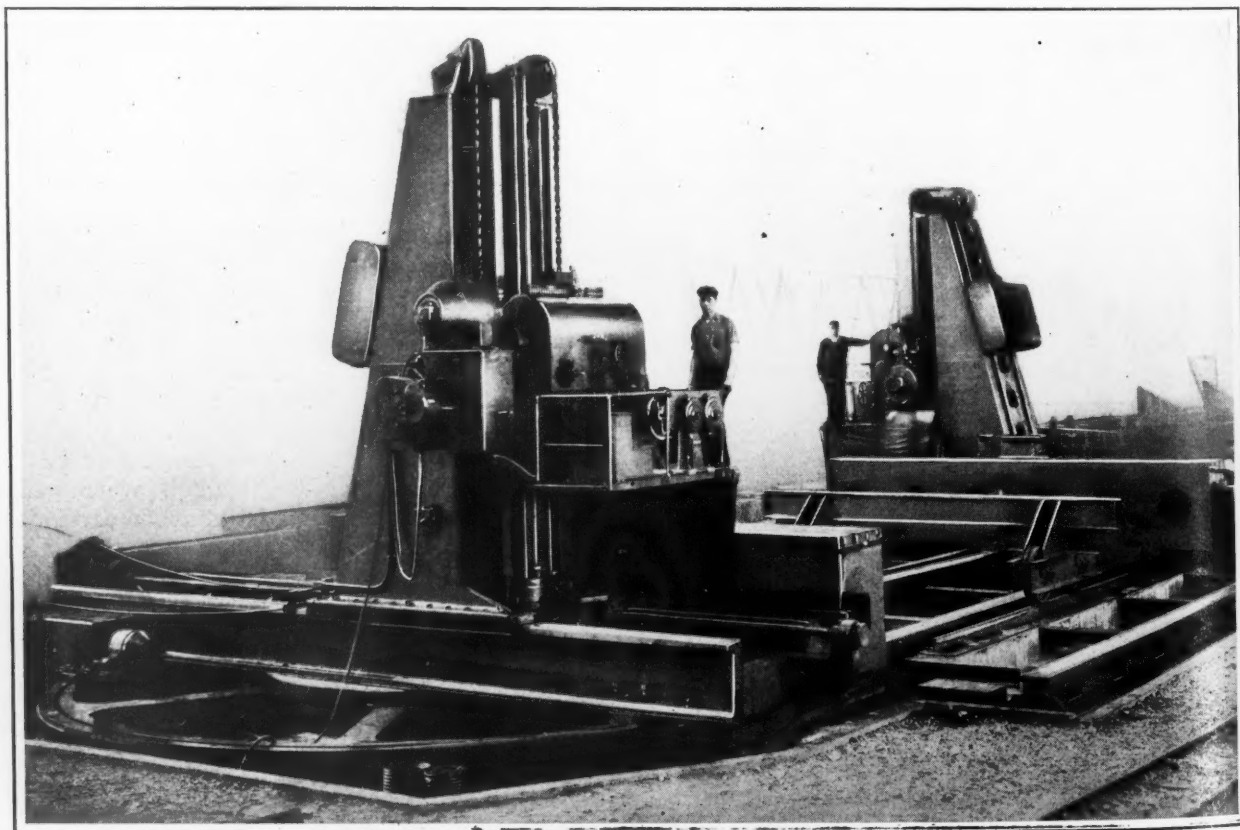


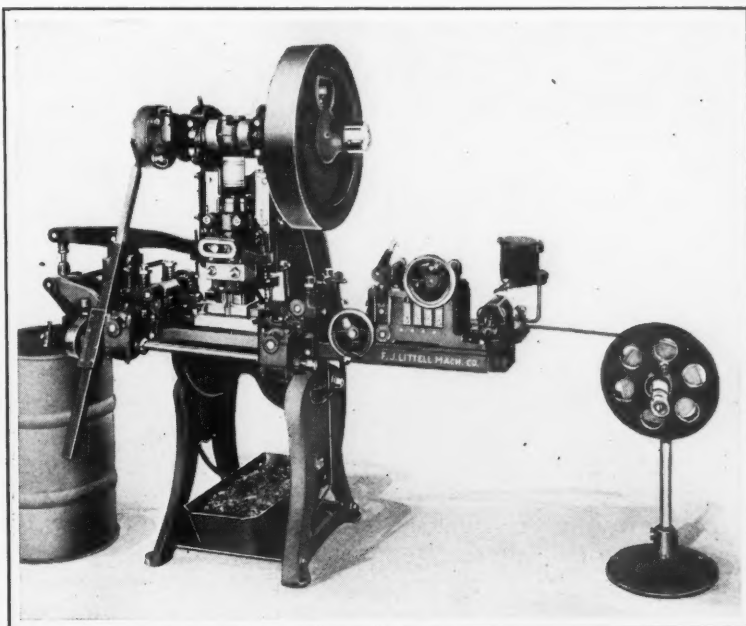
Fig. 2. Another View of the Sellers Machine with the Rotary Unit in the Foreground

The horizontal and vertical milling feeds are independent both in direction and amount, so that by combining them a cutter can be fed in any direction. It is possible to turn corners or to change the direction of feed without disengaging the feed; marks often caused on work by the interruption of the milling feed are, therefore, eliminated. This machine will mill the ends of columns or other structures measuring up to 20 by 12 by 60 feet.

#### LITTELL STRAIGHTENER FOR SPRINGY STOCK

A nine-roll straightener designed particularly for use with light springy stock has recently been brought out by the F. J. Littell Machine Co., 4125 Ravenswood Ave., Chicago, Ill. This device is shown in the illustration applied to a power press. It is arranged with a hand-driven feeding mechanism so that it need not be used with a roll feed. However, the straightener may also be used in conjunction with a roll feed and may be equipped with an oiler if desired. The straightener can be set on a table next to a press and the stock fed to any desired length. The rolls are small and set close together so that springy stock may be easily straightened.

A hand-feed straightener of this type is particularly recommended by the manufacturer when long strips must be fed from coils, and straightened. Stock up to 3 1/2 inches wide can be handled by this No. 2 straightener. A No. 3 size, which accommodates stock 5 inches wide, is also made, this size having seven rollers instead of nine, as used in the No. 2 machine.



Power Press with Littell Straightening Device for Springy Stock

#### ANDERSON HORIZONTAL DRILLING AND TAPPING MACHINE

A multiple-spindle dial-feed drilling and tapping machine in which all spindles and the axis of the feed dial are located in horizontal planes, is now being introduced to the trade by the Anderson Die Machine Co., Bridgeport, Conn. Other drilling and tapping machines built by this company have the spindles arranged vertically and the axis of the feed dial is also in the vertical plane. The horizontal design is particularly adapted for machining long holes in metal from which stringy chips are produced, as the chips drop freely from the dial.

All operating parts of the new machine are similar in construction to corresponding parts of the

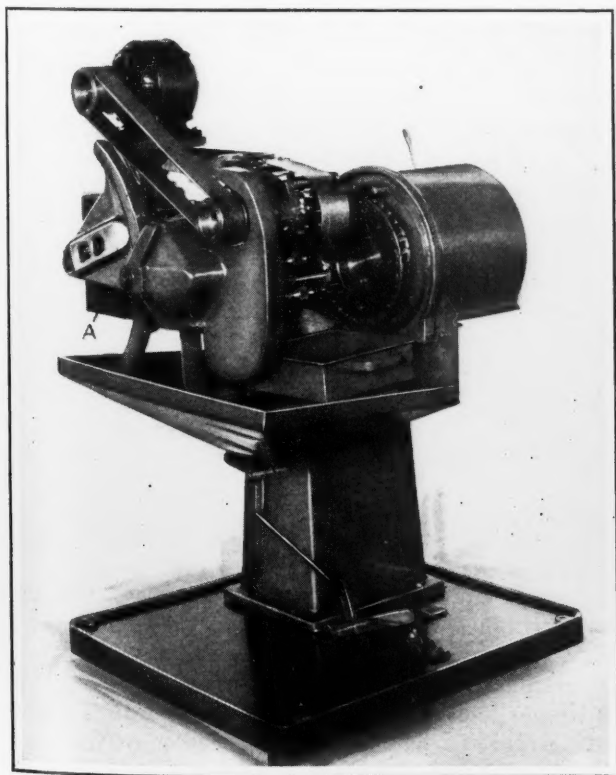


Fig. 1. Anderson Drilling and Tapping Machine of Horizontal Design

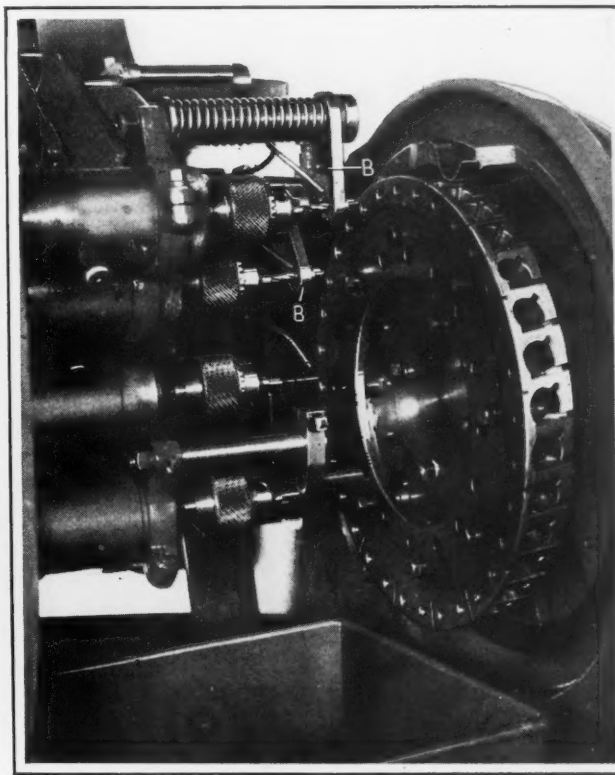


Fig. 2. Close-up View of the Drilling and Tapping Spindles and Feed Dial



standard No. 40 machine built by the company. Two motors are employed for driving the various units, the motor seen in Fig. 1 providing power for driving the drilling spindles. The other motor, which is not visible in the illustrations, but which is fastened to bracket A, Fig. 1, is the main driving motor and furnishes power for the tapping spindles and all other operating parts of the machine, with the exception of the drilling spindles. All drilling and tapping spindles are mounted on a slide which moves forward and backward on ways to carry the drills and taps to and from the work. During the return movement of the spindle slide, the feed dial indexes to place new pieces of work in line with the spindles. The operation of the machine is automatic, the work of the operator consisting solely of loading the feed dial.

As shown in the illustrations, the machine is equipped for drilling and tapping a hole in small malleable-iron junction box connectors. There are two drilling spindles and two tapping spindles and, hence, two parts are finished with each stroke of the spindle slide. The machine can be operated at

the Oilgear Co., 660 Park St., Milwaukee, Wis., are apparent in the accompanying illustrations. In the new design, the piping extending from the pump to the cylinder has been greatly simplified; this has considerably improved the appearance of the machine by affording greater compactness. The safety and unloading valves were formerly located in the pipe lines, which arrangement required an unnecessary amount of piping and joints. As shown in Fig. 2, the safety and relief valves are now mounted on the pump itself. The improved appearance of the machine, resulting from the elimination of the piping beneath the cylinder, will be apparent by comparing Fig. 1 with the illustration of the previous machine shown on page 423 of *MACHINERY* for January, 1926. The pump in Fig. 2 is of the variable delivery type and has a normal working pressure of 700 pounds per square inch.

Another improvement made in the broaching machine consists of a control bracket guard which has been incorporated as a safety feature to prevent injury to the operator's hands through carelessness. Also, sea ring ram packing has been

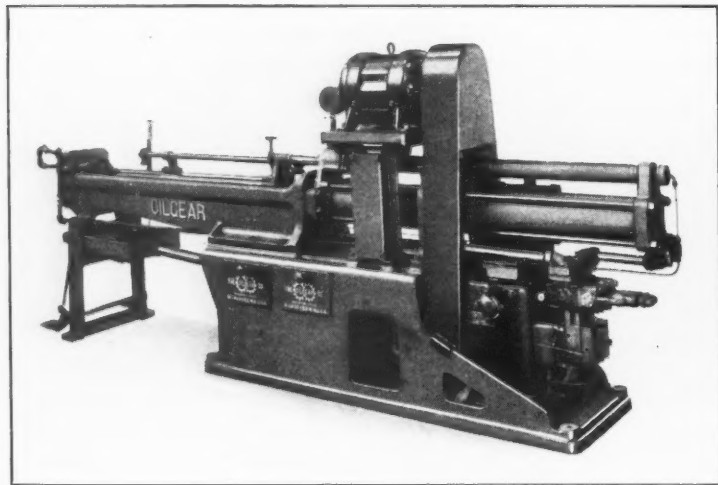


Fig. 1. Oilgear High-speed Broaching Machine Embodiment of Various Improved Features

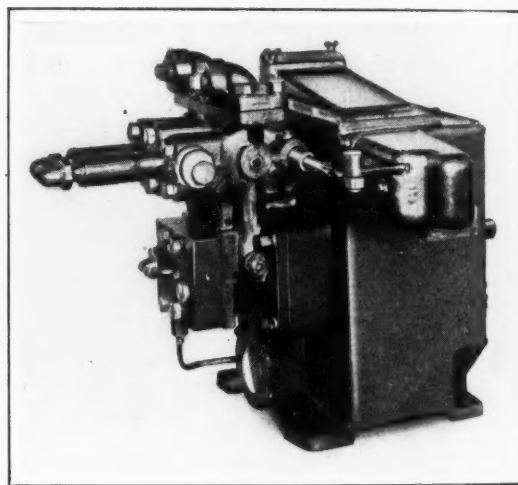


Fig. 2. Oilgear Pump with Safety and Relief Valves Directly Attached to It

a speed of thirty strokes per minute which gives a production of sixty pieces per minute. Thirty-two openings are provided around the feed dial to receive the work pieces. These pieces vary somewhat in size and the openings are sufficiently large to allow for variations.

Accurate drilling of the hole in the parts is insured by bushings attached to arms B, Fig. 2, which are provided for the drilling spindles. These bushings enter holes in the face of the feed dial and press against the work pieces holding them firmly during the drilling operation. This clamping action occurs before the drills touch the work. In the tapping, the taps follow the drilled holes.

In the event that a piece is not placed correctly in the feed dial, a stop prevents the dial from indexing and the spindle slide is also prevented from advancing. These provisions guard against damage. The feed dial can be rotated backward by means of a convenient lever, if required.

#### OILGEAR BROACHING MACHINE

Various improvements recently made in the design of the high-speed broaching machine built by

adopted as standard on all machines, as during the past four years this type of packing has proved unusually satisfactory in the solution of the leakage problem around rams and piston-rods.

The cross-head on the broaching machine is now provided with a convenient adjustment for raising and lowering the draw-head slide to suit different center lines of pull. This feature is especially valuable in broaching keyways when it is necessary to take two draw cuts with a cutter-bar and then raise the center line of the draw-bar in order to obtain the proper depth of keyway.

#### ALUMINUM CASES FOR BROWN INSTRUMENTS

Die-cast aluminum cases and cover bezels are now furnished as standard for practically all instruments made by the Brown Instrument Co., Philadelphia, Pa. Among the advantages claimed for these die-cast parts are lightness, resistance to rusting and corrosion, and the absence of flaws.

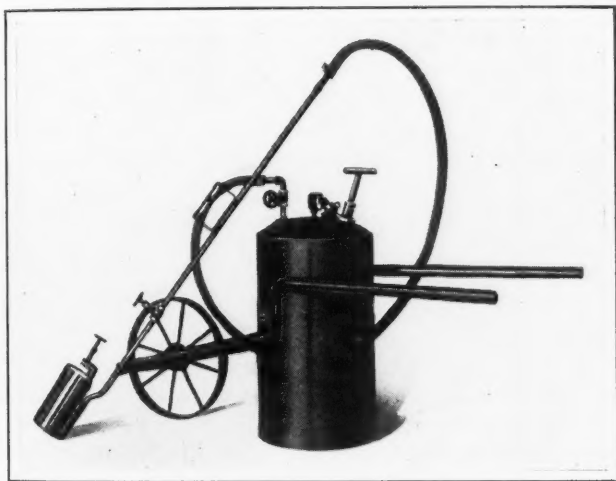
To a great extent, the cases for the different instruments are of uniform dimensions. For instance, the continuous-chart recording pyrometers,

resistance thermometers, tachometers, etc., all take a standard case, as do also the round-case instruments such as flow meters, thermometers, pressure gages and vacuum gages. Uniformity of appearance is provided by this standardization of cases.

The cases for continuous-chart recorders are among the largest aluminum die-castings ever produced on a quantity basis. They are 15 inches long by 13 inches wide by 7 inches deep.

#### CHAUSSE PORTABLE OIL BURNER

A portable kerosene-burning outfit which is adaptable to work such as preheating metal parts before welding is shown in the accompanying illustration. This outfit is a recent product of the Chausse Oil Burner Co., 1227 W. Beardsley Ave., Elkhart, Ind., and is so designed that one man can handle a conventional-type welded tank having a capacity of 14 gallons of kerosene. This tank is mounted on tubular steel shafts and is supported



Chausse Portable Oil Burner which may be used to Preheat Parts to be Welded

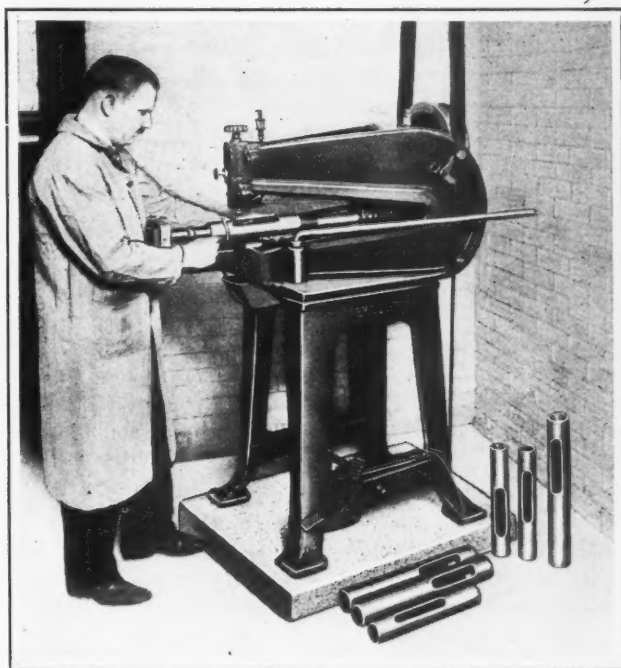
by a single wheel when moved from place to place.

The tank has a self-contained air pump and pressure gage. A kerosene burner is attached to it by means of pneumatic hose. The burner handle is made of steel and is equipped with a wooden grip and a convenient needle valve. This burner is self-generating and produces a temperature of from 1750 to 1800 degrees F.

#### CAMPBELL NIBBLING MACHINE

Adaptation of the model 1-B nibbling machine manufactured by Andrew C. Campbell, Inc., Bridgeport, Conn., for the production of slotted tubes used in the manufacture of oil burners, is here illustrated. This machine has a special head with an outboard bracket in front, and a block in the throat of the machine which gives an effective throat depth of 16 inches.

A mandrel is employed which closely fits the inside of the Shelby steel tubing to be cut. There is also a templet which is made up of two half-tubes that are hinged with a quick-acting clamp. This templet can be quickly attached to the tube being cut. There is also a quick-acting swing-clamp on the outboard bracket for holding the outboard



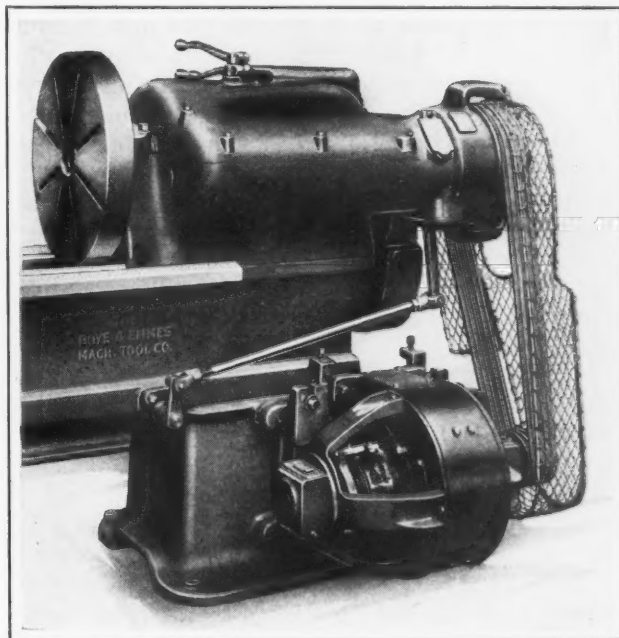
Campbell Nibbling Machine Arranged for Slotting Tubes

mandrel support. The arrangement enables tubes to be quickly put on or taken off. A separate operation for finishing the slot produced is unnecessary, as the edge left by the nibbler is practically smooth.

According to time studies made after the machine was installed, the operating time necessary for cutting holes in the sides of the tubes was reduced by the new machine from 16 minutes to 40 seconds per tube.

#### BOYE & EMMES LATHES EQUIPPED WITH "TEXROPE" DRIVES

All sizes of motor-driven engine lathes built by the Boye & Emmes Machine Tool Co., Cincinnati, Ohio, may now be equipped with a "Texrope" drive instead of with a geared motor drive or a motor drive through a flat belt. The illustration shows this type of drive applied to a 20-inch lathe, the



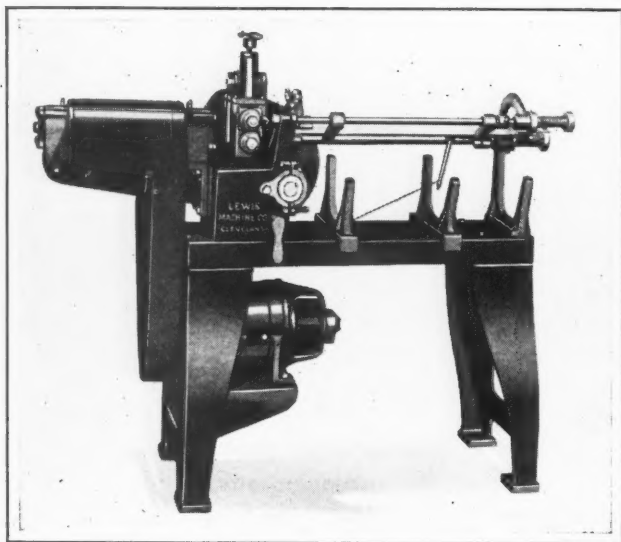
Boye & Emmes Lathe Equipped with "Texrope" Drive



arrangement being typical on all sizes of machines. The motor is mounted on a planed pad at the rear of the headstock pedestal and has a vertical adjustment to obtain the proper tension of the belts. It is intended that a motor running at a speed of not more than 900 revolutions per minute be used. A wire-mesh guard protects the pulleys and belts.

### LEWIS ROTARY WIRE-STRAIGHTENING AND CUTTING MACHINE

An automatic motor-driven wire-straightening and cutting machine of medium weight has recently been placed on the market by the Lewis Machine Co., 6303 Central Ave., Cleveland, Ohio. This machine is built in two sizes, one of which handles wire up to  $3/16$  inch in diameter and the other up to  $1/4$  inch in diameter. The straightener arbor of this No. 7-C machine consists of five sets of dies. Either iron or bronze dies are used, depending upon the finish of the wire being straightened.



Lewis Automatic Wire Straightening and Cutting Machine

A clutch similar in construction to a standard punch-press clutch is provided. The operating parts of the clutch have been reduced to a minimum and consist only of a trip-lever and a clutch dog which drives the flywheel shaft. This shaft only revolves when wire is being cut off. The cutter-bar is operated by a cam on the flywheel shaft. A ball bearing mounted in the cutter-bar runs on this cam.

The feed-rolls are geared direct to the flywheel. An automatic feed-roll release lever removes pressure from the feed-rolls when wire is being cut off. This prevents slipping of the feed-rolls on the wire during the cutting off, thus avoiding marking of the wire and greatly increasing the life of the rolls.

One of the features pointed out is a double Allis-Chalmers "Texrope" drive from a motor mounted on a bracket bolted directly to the left-hand machine leg. The motor has a rating of  $1\frac{1}{2}$ -horsepower and runs at 1800 revolutions per minute. Timken tapered roller bearings are furnished for the straightener arbor, main drive shaft and flywheel. The floor space required for a 2-foot machine, not including the reel, is  $16\frac{1}{2}$  by 36 inches. The floor space for a 3-foot machine is  $16\frac{1}{2}$  by 48 inches.

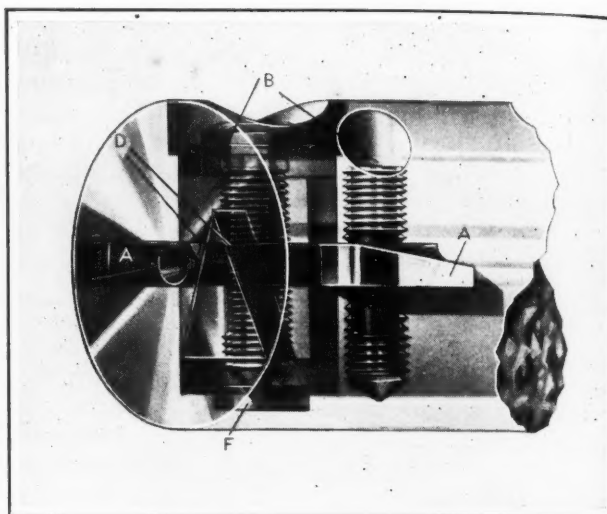


Fig. 1. Improvements of New Davis Boring Tool

### DAVIS IMPROVED MICROMETER EXPANSION BORING TOOL

An improved type L micrometer boring tool has recently been developed by the Davis Boring Tool Co., Inc., Division of the Larkin Packer Co., 6200 Maple Ave., St. Louis, Mo. This improved tool is made from hammered heat-treated stock. The locking gib of previous designs has been removed and each cutter A (see the accompanying illustrations) is now locked by means of a piloted hardened and ground eccentric lock screw B, in a slot of the same width as the cutter. With this new construction, the bar has been strengthened and a positive locking of each cutter has been obtained. An improved self-guiding expanding wedge C eliminates the need of a wedge guide and the necessity of having a hole entirely through the bar. This feature also adds considerable strength to the bar. The action of the wedge on the cutters is illustrated at D.

A micrometer adjustment screw E of new design is provided. This screw is piloted in a hardened and ground self-centering thrust bearing F, there being a full thread bearing no matter what the position of the wedge. The cutters used in this boring-bar are interchangeable with those of old-style Davis boring tools employing the regular cutters ordinarily furnished in the past.

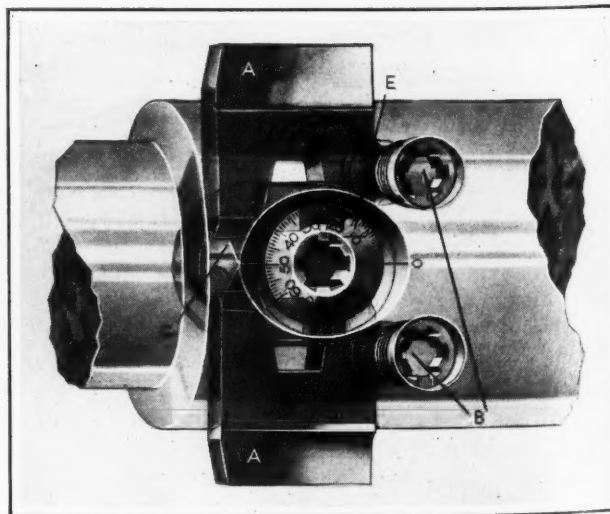
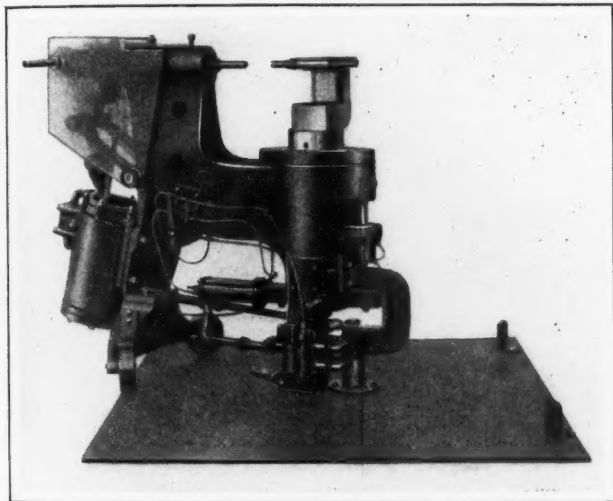


Fig. 2. Another Illustration of the Improved Davis Boring Tool

## HANNA CHASSIS-FRAME RIVETER

The latest addition to the line of pneumatically operated riveting machines built by the Hanna Engineering Works, 1763 Elston Ave., Chicago, Ill., is here illustrated. This machine is particularly suited to driving the web rivets in the side bars of automobile chassis frames. The stake which supports the stationary die, and which enters the interior of the chassis frame, can be rotated upon its vertical axis to permit indexing and locking it in two positions, 180 degrees apart.

The upper portion of the stake adjacent to the die mountings is offset or "goosenecked." By indexing the stake, this offset can be thrown to the right or to the left, as desired. The advantage of this arrangement lies in the fact that the stationary die may be centered upon a rivet that joins a channel-shaped cross member to a side-bar channel web, whether the flange legs at the top and bottom of the cross member extend toward the front or toward the rear of the chassis frame. The stake



Hanna Riveter for Driving a Diversity of Rivets in Automobile Chassis Frames

has double die mountings on one axis so that a die is always in position to oppose the live die regardless of the stake indexing. This feature permits the riveter to perform operations that would otherwise require two machines.

The riveter is mounted on a radially rolling base which permits conveniently swinging it from the operating position on one side of a suspended chassis frame into the operating position on the other side of the frame. This combination of an indexing stake and a radially rolling base enables the machine to drive as great a diversity of web rivets as four ordinary chassis-frame riveters without these features. The machine is, therefore, particularly adaptable to the production of truck and pleasure-car frames in shops where there is a comparatively small daily output, but where the work still must be performed efficiently and at a reasonable cost.

The size of riveter here shown exerts a force of 30 tons on the dies with an air-pressure of 100 pounds per square inch, and will drive rivets up to 3/4 inch in diameter hot, and up to 7/16 inch in diameter cold. The riveter is also available in 15- and 20-ton capacities.

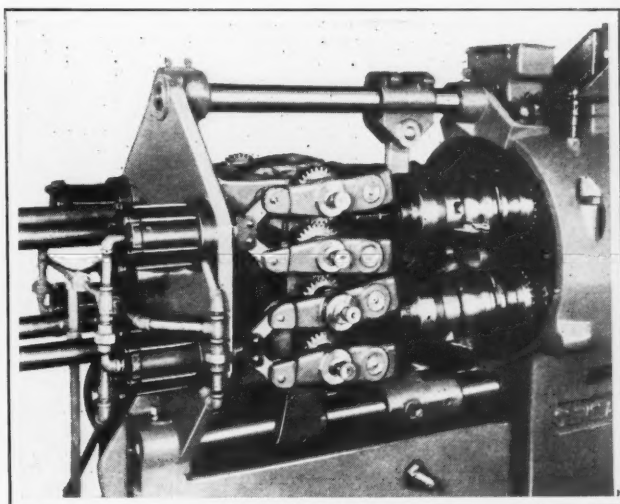


Fig. 1. Roll-feed Mechanism Recently Applied to Cleveland Automatics

## ROLL-FEED MECHANISM FOR CLEVELAND AUTOMATICS

A roll-feed mechanism recently developed by the Cleveland Automatic Machine Co., 2269 E. 65th St., Cleveland, Ohio, for use on a four-position automatic is shown in the accompanying illustrations. This mechanism was designed primarily to permit the rapid production of pipe-coupling blanks from 35-foot hot-rolled stock bars 1 9/16 inches in diameter. The operations of drilling, forming the corner at the outside, stenciling the manufacturer's mark and cutting off are performed simultaneously at all four spindles. Thus four blanks are produced with each feed period of the machine.

In the new mechanism, V-shaped feed-rolls are mounted on the toggle arms seen in Fig. 1. These rolls are driven continuously by a system of gears actuated through a chain and sprockets. One of these sprockets is geared to the lower camshaft at the rear of the machine. Cams on the same shaft control the action of air cylinders which govern the roll mechanism by operating four pistons to impart a jaw action to the toggle arms that carry the rolls. Each pair of rolls closes on a bar independently of the others and so any variation in the size of a bar does not affect the feeding of the other bars.

The four bars are gaged for position in the ma-

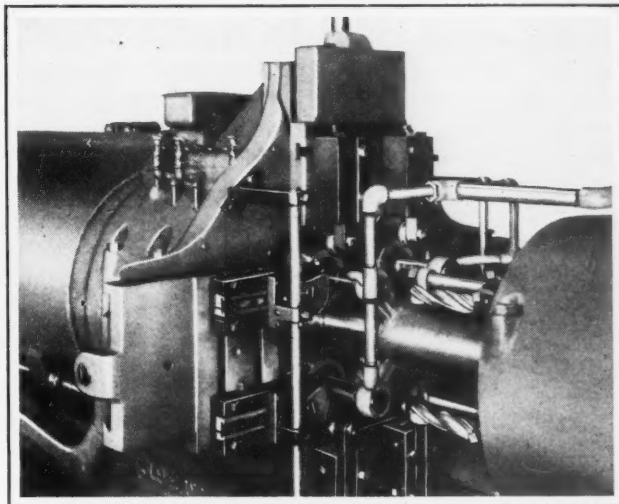


Fig. 2. Arrangement of the Tool Slides and Gage Stops



chine by four stops mounted on a central drive-shaft sleeve as shown in Fig. 2. These stops have a longitudinal movement with the sleeve. After gaging the stock, they are withdrawn slightly for chip clearance and, simultaneously, a sliding shoe actuated by a cam and drum on the lower shaft operates four thimbles to close the chucks. Thus the stock is chucked on live spindles. The feed-rolls meanwhile release the stock when the air is reversed in the cylinders to reverse the jaw action of the toggle arms.

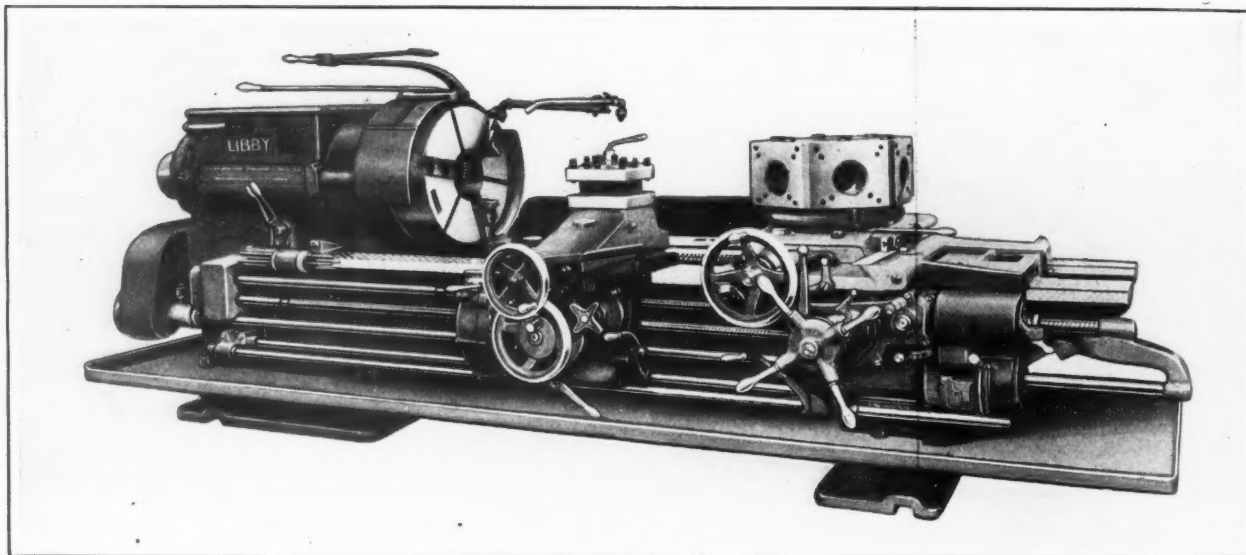
When the gage stops recede, the turret advances four drills which operate through openings in the stops; consequently, the stops also act as tool guides and strippers. Simultaneously, tools mounted on four cross-slides two of which may be seen in Fig. 2, form the outside corner of the stock bars and cut off the blanks. Stenciling is accomplished by means of a pivoted sector which advances with each slide and rolls the manufacturer's mark into the blank with the motion of the stock, the sector being held out of position after one pass. Stripping of the

work as by the use of simple standard tools, a large variety of work can be handled.

Design features include heavy gibbed tri-way bearings. The turret-slide is made in one piece over and under the back way and has a taper gib running the entire length of the slide. These features provide unusually large bearing surfaces which add to the rigidity of the machines. Convenient adjustments are available to compensate for wear.

The turret has power cross- and longitudinal-feeds which are independent of each other, of the quick traverse, and of the tool-post carriage. There are automatic trip-offs for the cross-feed. The tool-post and turret carriages are provided with large easily read dials for both the longitudinal and cross-feeds. The bottom slide is furnished with a scale to show the exact position of the turret-head in relation to the spindle.

An extra-heavy taper attachment of new design is provided for all power-feed cross-sliding turret lathes. One of the features of this attachment,



Libby-International Turret Lathe with Power-feed Cross-sliding Turret

four cut-off blanks, and gaging of the stock for the next four pieces to be produced are accomplished with a single forward motion of the gage stops. The turret of the machine is non-indexing, as there is no need for an indexing movement.

The long bars from which the couplings are produced are supported while in the machine by four tubular housings which, in turn, are supported at intervals by means of adjustable standards. Subsequent beveling of the hole in the couplings produced by means of the equipment here illustrated, is performed in a special model J double-end machine built by the same company. The pieces are then tapped.

#### LIBBY-INTERNATIONAL CROSS-SLIDING TURRET LATHES

A power-feed cross-sliding turret has been developed for all sizes of turret lathes built by the International Machine Tool Co., Indianapolis, Ind. This turret makes the machine universal for either quantity or small-lot production. Machines so equipped are particularly suitable for maintenance

which saves considerable time, is that by merely withdrawing a pin, the operator can alternate from straight to taper work.

#### MOTOR-DRIVEN MICA UNDERCUTTER

A motor-driven device recently brought out by the Ideal Commutator Dresser Co., 1011 Park Ave., Sycamore, Ill., for undercutting the mica between the copper plates of commutators, is here illustrated as applied to a typical operation. This "Ideal" undercutter is so constructed that it can be used without removing a single brush of a commutator, and can be operated in a space only 3 inches wide.

The undercutter will produce slots up to approximately 1/4 inch deep from the risers. Worm-gearing and the small-diameter saws or milling cutters used, result in a comparatively slow cutter speed, thereby eliminating any tendency of the cutter to jump out of the slots and gouge the copper-bars. A gage located next to the cutter provides for easily measuring the depth of cut. The undercutter is also equipped with a micrometer



Motor-driven Mica Undercutter Made by the Ideal Commutator Dresser Co.

grease can escape, nor mica enter the gears.

The motor is of 1/4-horsepower capacity and runs at 1725 revolutions per minute. It may be suspended at any angle from a convenient support as it is equipped with a special hanger base and a thrust bearing. The manufacturer recommends that a 7/8-inch milling cutter or saw be used with the undercutter. Twelve saws or four milling cutters are regularly furnished.

#### ROGERS GRINDING-WHEEL CHUCK

Simplicity of construction is the principal feature claimed for a new segmental grinding-wheel chuck recently brought out by Samuel C. Rogers & Co., 191-205 Dutton Ave., Buffalo, N. Y. While this chuck is intended primarily for application to the new knife grinders built by the company, it is so designed that it can be used on both face and surface grinders of other makes.



Rogers Chuck for Segmental Grinding Wheels

This new chuck is made in five sizes, 12, 14, 16, 18 and 22 inches in diameter, respectively. The chuck illustrated is 14 inches in diameter and has eight grinding segments 4 by 4 by 1 1/4 inches. These segments are mounted in a machined member having simple adjustable parts which provide for securely holding and conveniently replacing the segments. From the illustration it will be seen that the chuck has an inner ring and two sets of clamping wedges. When the segments are worn halfway down, the outer wedges and the inner ring are removed, after which the wheel is continued in use until the segments have been completely used up. Then the clamping wedges of the second row are loosened, the butts of the segments removed, new segments inserted and both rows of clamping wedges replaced. The wheel is protected by a guard which is adjustable to the wear of the segments.

#### CANEDY-OTTO SLIDING-HEAD MOTOR-DRIVEN DRILLING MACHINE

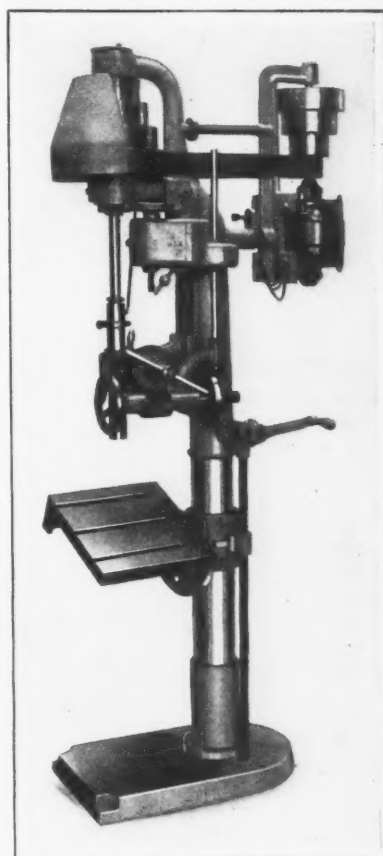
A 17-inch sliding-head drilling machine has recently been placed on the market by the Canedy-

adjustable guide so constructed that only one slot need be cut by hand; the guide then operates in the slot next to that being produced. The plate over the gears is attached tightly so that neither the

Otto Mfg. Co., Chicago Heights, Ill. This machine is built either in the self-feed type illustrated or in a hand-feed type. It has a direct belt drive from the motor to the spindle. The driving belt connects a four-step cone pulley driven by the motor, with a corresponding cone pulley attached to the spindle. Roller bearings are furnished in the spindle cone pulley, and the spindle is provided with a ball thrust bearing. Belt tightening is accomplished by means of the sliding member to which the motor is attached. This member is merely moved in or out to place the desired tension on the belt. It is locked in place by means of a screw.

Four rates of self-feed are available and these can be changed from one to the other while the machine is in operation. Four spindle speeds of 260, 540, 960, and 1580 revolutions per minute are obtainable. The machine can be furnished with either a square tilting table, as shown, or with a round table having a surrounding oil-groove.

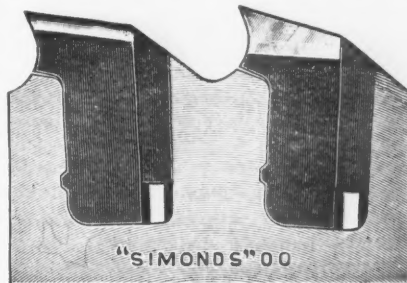
Some of the specifications of this machine are as follows: Size of motor, 3/4-horsepower; vertical adjustment of head on hand-feed machine, 12 inches, and on self-feed machine, 10 1/2 inches; travel of spindle, 7 inches; maximum distance from spindle to table and from spindle to base, 31 and 41 inches, respectively, distance from column to center of table, 8 1/2 inches; and largest size of drill for which the machine is intended, 7/8-inch.



Canedy-Otto Drilling Machine of Self-feeding Type

#### SIMONDS INSERTED-TOOTH SAWS

Inserted-tooth metal-cutting saws of a new design are being placed on the market by the Simonds Saw & Steel Co., Fitchburg, Mass., under the "Red Streak" trade name of the company. The inserted teeth are made of high-speed steel and are designed with a view of permit-



Design of Inserted Teeth in Simonds New Metal-cutting Saws

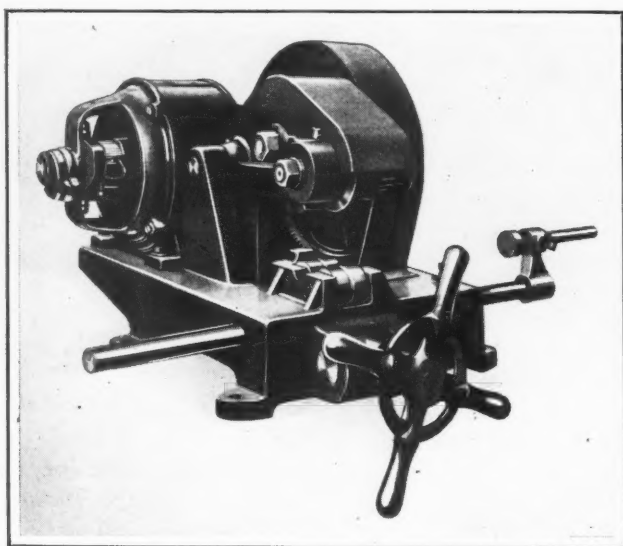


ting high cutting speeds. Every other tooth is rounded on top and is slightly higher than the alternate teeth. These round-top teeth engage the work first and cut a groove. The square-top teeth follow through, cleaning out the corners of the cut and breaking the chips into three pieces. Curved gullets of a new type eliminate any danger of the chips becoming welded to the teeth, thus causing possible damage to the saw or machine.

Through the use of high-speed steel teeth, much greater cutting speeds, feeds, and depths of cut can be taken than is possible with solid-tooth carbon-steel saws. The body of the new saws is made of a tough alloy steel that will stand up under heavy feeds. The saws cut a kerf as narrow as that produced by the usual solid saws. It is not necessary to remove the inserted teeth for sharpening. When worn out, they can be easily replaced. Seven sizes of teeth are made for saws from 6 to 72 inches in diameter. Larger saws can be made to specifications.

#### OSTER POWER PIPE CUTTER

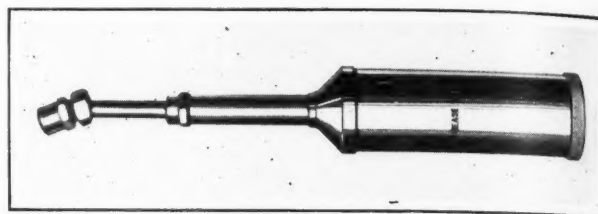
A portable machine for cutting off pipe and tubes from 1/4 to 2 inches in diameter, recently placed on the market by the Oster Mfg. Co., Cleveland,



Oster Portable Power Pipe Cutter

Ohio, is here illustrated. This machine has a cutter-disk contained in a movable arm that is brought down on the roller-supported pipe. With this arrangement, the pipe remains at right angles to the cutter-disk at all times, insuring a clean square cut and lengthened life of the cutter-disk. The action of the cutter-disk arm is controlled by a screw feed and handwheel.

The machine is equipped with a length gage which can be set to cut nipples from "close" to 3 feet long on either side of the cutter-disk. If a quantity of pipe is to be cut to lengths greater than 3 feet, an ordinary piece of pipe can be used with the standard stock stop as a length gage. This pipe cutter can be furnished in either belt- or motor-driven models, a 1-horsepower motor being supplied with the motor-driven type. An all-metal stand can be furnished for mounting the machine at a convenient operating height.



High-pressure Grease Gun Made by the Grease-Rite Corporation

#### HIGH-PRESSURE GREASE GUN

A high-pressure grease gun is now being placed on the market by the Grease-Rite Corporation, Cleveland, Ohio, for lubricating machine tools and other machinery. It is particularly suited for use in lubricating heavy machine tools, cranes, punch presses, rolling mills, foundry equipment, etc. Changes from present methods of lubrication to the "Grease-Rite" system can be made without shutting down equipment. With this system, dust-proof fittings are filled from time to time with lubricant under pressure by means of the grease gun here illustrated.

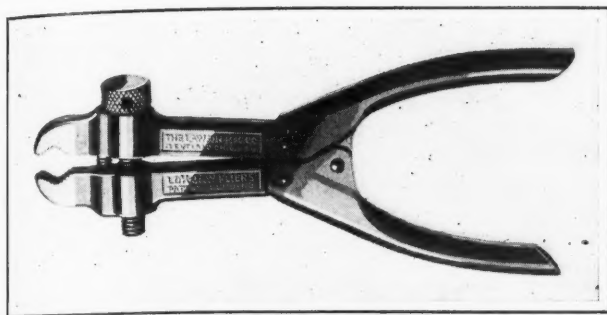
This grease gun is loaded with lubricant by removing the rear cap and then filling the barrel. In forcing lubricant into a fitting, the nose of the gun is slipped over the fitting and then the gun is operated by pushing the barrel forward. Any desired pressure and volume of lubricant can be obtained by simply making a long or a short stroke. In the nozzle of the grease gun there is a contracting steel thimble which hugs the body of the fitting tightly when pressure is applied to the lubricant and which will instantly release when the pressure stops. Two sizes of this grease gun are made.

#### BLACK & DECKER HEAVY-DUTY ELECTRIC DRILL

A 3/4-inch heavy-duty portable electric drill for straight-shank drill bits is now being introduced to the trade by the Black & Decker Mfg. Co., Towson, Md. This drill is equipped with a universal motor for operating on direct or alternating current. The armature and spindle are mounted on ball bearings. A three-jaw geared chuck is provided. The drill is designed for drilling holes up to 3/4 inch in diameter in the toughest steel.



Black & Decker Drill for Straight-shank Drill Bits



"Lok-Jaw" Pliers which have a Locking Screw at the Jaws

### LAWSON "LOK-JAW" PLIERS

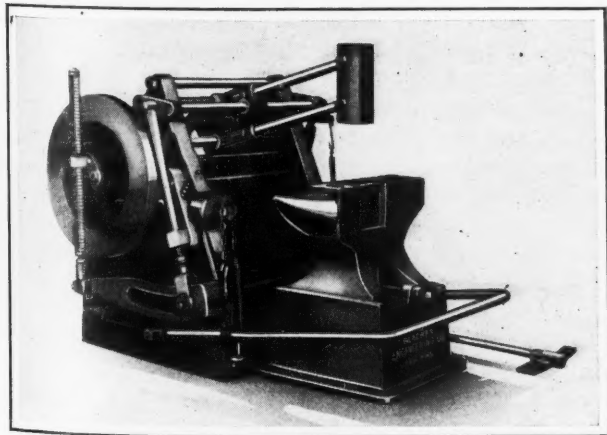
Pliers equipped with an adjustable screw by means of which their jaws can be securely locked to parts, are now being placed on the market by the Lawson Mfg. Co., 2720-24 E. 53rd St., Cleveland, Ohio. These pliers are so designed that a compound leverage gives unusual gripping power at the jaws. The jaws are designed to fit round, square or hexagonal parts, and open  $\frac{3}{4}$  inch. They are steel forgings, and are hardened and tempered. The handles are made of pressed steel and have knurled grips.

These pliers may be clamped to a nut or bolt-head in an out-of-the-way place to keep such parts from turning while a wrench or screwdriver is applied to their mating nut or bolt, as the case may be. The pliers are 8 inches long.

### BLACKER IMPROVED BLACKSMITH HAMMER

A 1928 model blacksmith hammer has recently been brought out by the Blacker Engineering Co., Inc., Grand Central Terminal, New York City. While this machine incorporates the same operating principles as the hammer described in *MACHINERY* for March 1925, it has been improved in its various details and is larger and heavier throughout. The motor drive has been re-arranged to give a compact unit, and thrust bearings are now provided for the control mechanism.

A single blow can be struck with the hammer or it can be operated at the rate of 140 blows per

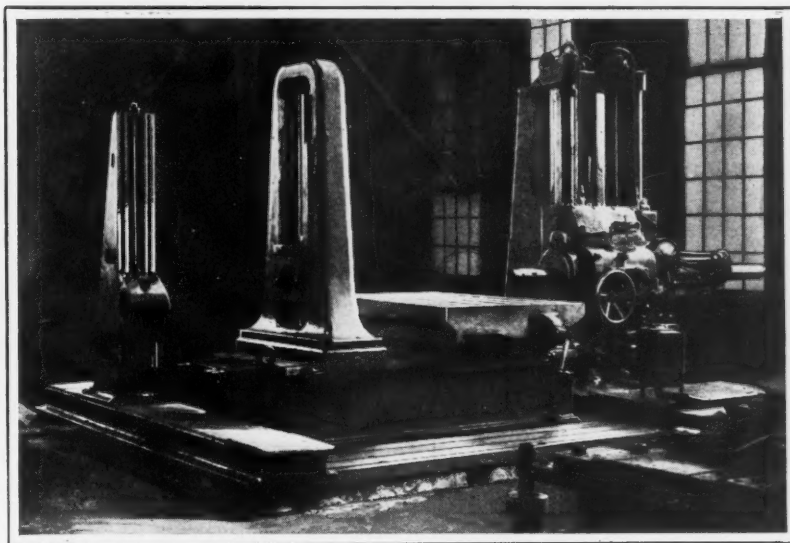


Blacker Improved Blacksmith Hammer

minute. The blows can be varied from a light tap to about four times as heavy as the blows struck with a hand-swung sledge by the average blacksmith. Foot treadles regulate the force of the blows and the lateral traverse of the hammer head along the anvil face. The anvil weighs 500 pounds. The central cut-out in the front of the anvil permits double-shouldering operations.

### RYERSON HORIZONTAL DRILLING, BORING AND MILLING MACHINE

A combination floor- and table-type drilling, boring and milling machine was recently built by Joseph T. Ryerson & Son, Inc., 16th & Rockwell Sts., Chicago, Ill., for the Canadian Bridge Co., Walkersville, Ontario, Canada. This machine is designed for drilling, boring and milling both large and small parts, when the amount of work passing through the shop is insufficient to warrant separate floor- and table-type machines, and is therefore



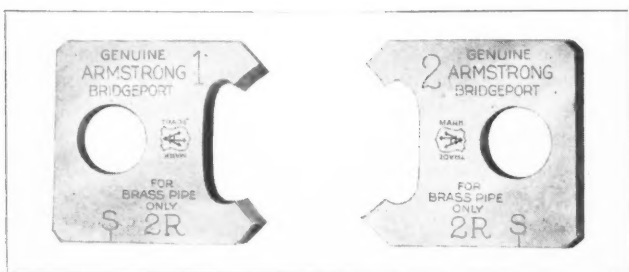
Ryerson Floor- and Table-type Drilling, Boring and Milling Machine

likely to meet the needs of many shops that do not manufacture any one line in great quantities, but which do a varied line of work.

As may be seen in the illustration, the machine is of standard floor-type and has a spindle saddle that moves vertically on its column; a column having a horizontal movement on its runway; a bedplate that is fastened to the runway; and an outer boring-bar support that has a hand movement along the bedplate. The machine is direct motor driven. All speeds, feeds, and the power traverse to the spindle, spindle head, and column are controlled from the head. The outer boring-bar support and the main post are fitted with a vernier and scales reading to 0.001 inch.

A special self-contained portable table is mounted on the bedplate as shown to facilitate the machining of small pieces. This table can be readily removed when it is desired to employ the machine for large work. The table has movements in two directions, that is, parallel with the spindle travel and parallel with the travel of the column. The operation is by hand, but the machine is so arranged that an electric motor can be used to obtain table feeds for milling and a rapid traverse.





Armstrong Dies for Brass Pipe Only

### ARMSTRONG BRASS-PIPE DIES

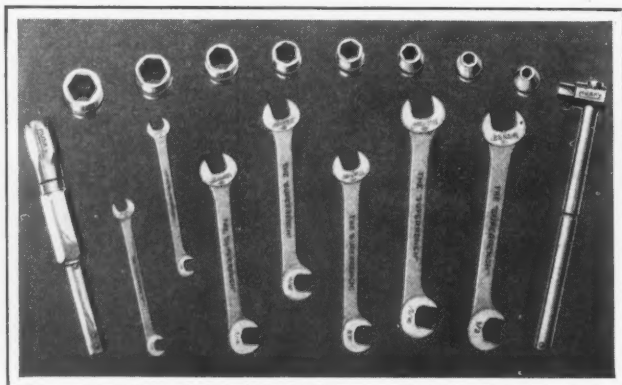
Dies designed especially for cutting threads on brass pipe are now being placed on the market by the Armstrong Mfg. Co., Bridgeport, Conn. These dies are carried in stock in the following iron-pipe sizes and in both right- and left-hand styles: 3/8, 1/2, 3/4, 1, 1 1/4, 1 1/2 and 2 inches. They are also carried in stock for plumbers' tubing of the following outside diameters: 1/2, 5/8, 3/4, 7/8, 1 and 1 1/4 inches, both in right- and left-hand styles. Gas-fixture dies for all twenty-seven threads are carried in stock in ten sizes ranging from 1/4 to 1 inch and in right- and left-hand styles. These dies are intended for Armstrong stocks.

### WILLIAMS-HUSKY COMBINATION ELECTRICAL WRENCH SET

Another combination wrench set made possible by the recent reciprocal sales arrangement between J. H. Williams & Co., Buffalo, N. Y., and the Husky Wrench Co., Milwaukee, Wis., is here illustrated. This combination of wrenches is known as "Electrical Set No. 287" and is intended for use on electrical equipment of all makes of automobiles, for use in general electrical and radio work, and for use in making delicate adjustments.

The set contains seven Williams' Midget chrome-molybdenum steel "Superwrenches" with the following openings: 7/32-, 1/4-, 5/16-, 11/32-, 3/8-, 7/16- and 1/2-inch. Each of these wrenches has two openings of the same size, but they are located at different angles, 15 and 75 degrees, respectively, so that where one head cannot be used, the other may. The wrenches are light and thin and have narrow, pointed jaws. They have a chromium-plated finish with buffed heads.

The Husky wrenches in the set include eight "Baby" sockets which are tapered for use in close quarters. These sockets have hexagonal openings

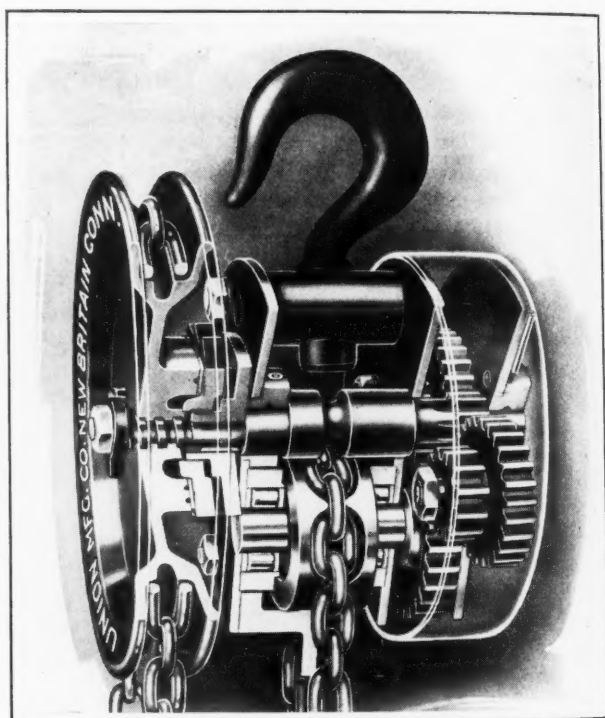


Williams-Husky Electrical Wrench Set which is Furnished in a Small Metal Box

of the following sizes: 5/32-, 3/16-, 1/4-, 5/16-, 11/32-, 3/8-, 7/16-, and 1/2-inch. There is also a 5-inch combination T-handle and a 4 1/2-inch handy grip. The latter can also be used as an extension. These wrenches have a bright nickel finish. The set is packed in a metal box measuring 5 1/4 by 2 3/4 by 1 inch. The total weight is 1 1/2 pounds.

### UNION SPUR-GEARED HOISTS

A "Red" line of spur-gear hoists of improved design is being placed on the market by the Union Mfg. Co., New Britain, Conn., in twelve sizes ranging from 1/2 to 20 tons in capacity. One of the principal features of these hoists is that the load is supported on large roller bearings enclosed in cages. All gears are cut and heat-treated. The



Union Spur-gear Hoist with Roller Bearings

handwheel shaft and driving-pinion bearing are supported beyond the intermediate gears.

All friction members and the gear train are enclosed in dust-proof cases. In the illustration, the front cover is removed in order to show the friction mechanism, and the circular plates are cut away so as to show the bearings, shafts, gears and pinions. There is a complete oiling system which employs self-cleaning and closing oil cups. The suspension system is of solid pressed-steel design. Three pressed-steel plates carry the load friction units and the gear train, respectively. The chain is made of a high-carbon steel, electrically welded.

The bottom hook is of a ball-bearing design and has a quickly detachable swivel. The swivel is made of two forgings which interlock with the chain link and carry the load. A bolt acts simply as a binder to clamp the swivel halves together. Heat-treated forged safety hooks are provided which open gradually under an excessive overload, giving sufficient time to lower a load safely. There is a one-piece malleable-iron hand-chain guide. The chain is easily removable without detaching the guide.

# The British Metal-working Industries

From MACHINERY's Special Correspondent

London, July 16, 1928

IN last month's letter, a check in the progress which has been made in the British metal-working industries since the beginning of the present year was noted, and it was pointed out that the next few weeks should serve to indicate whether the depression is merely temporary, or, as seemed more probable in view of experience gained in recent years, whether a gradual decline has set in. At the time of writing there is nothing to indicate that the latter prediction is not correct, and without wishing to be pessimistic, one cannot but infer that conditions in the metal-working industries will be substantially the same at the end of the present year as they were at the beginning.

Increasing automobile and bus competition is seriously affecting railway traffic receipts. The position from the railway point of view cannot but be regarded with anxiety. Sir Felix Pole, general manager of the Great Western Railway points out that "a continuance of falling revenues cannot be sustained without drastic and far reaching economies in expenditure." The railway companies have already made great efforts both to reduce their workshop costs, as for example, by introducing the line system for repair and construction.

As mentioned in a previous letter, the railways are seeking from Parliament power to enable them to run bus services on an equal footing with other bus transport undertakings and it would seem probable that here lies the solution to the problem, and that the institution of such services will enable the railways to recover much of their lost business.

## The Olympia Machine Tool Exhibition

Some 110 firms engaged in the machine tool and allied industries will participate in the machine tool exhibition which is being held at Olympia, September 5 to 22. Not until the exhibition opens will it be possible to appreciate to the fullest extent the important developments that have taken place in almost all branches of the machine tool industry since the last exhibition in 1924, but it is safe to predict that the number and variety of machines will eclipse anything previously seen in London.

Machine tool builders are finding the requirements of their customers increasingly exacting. In the majority of cases guaranteed production times are required, and as a rule, unless these show very material improvements over present methods, there is small hope of an order being placed. It is stated, for instance, that some of the railway companies require proof of a 10 per cent saving over previous methods to secure consideration for plant replacements.

In consequence, machine tool builders are devoting more and more time and money to experimental and demonstration work. Bearing in mind the fact that two of the most important buyers of machine tools, namely, the railway and automotive

industries, are not at the moment buying freely, machine tool builders would appear, on the whole, to be surprisingly well employed. This applies more particularly to the large firms that are not dependent on one or two specialties.

The "Cloudburst" hardness testing and work hardening machine developed by E. G. Herbert is now being manufactured by B. & S. Massey Ltd., Openshaw, Manchester. This ingenious machine, in which the part to be tested or hardened is submitted to a rain of steel balls, is likely to revolutionize the surface hardening of many parts, in addition to simplifying and accelerating the tedious work of hardness testing.

## Overseas Trade in Machine Tools

The machine tool exports during May showed a falling off in tonnage sufficient to check any rising tendency which might be observed in the figures for the four preceding months. Thus the exports for May amounted to 1,081 tons as compared with 1,530 tons in April and 1,229 tons in March. At the same time the fall in total value was less marked, the May figure being £146,429 as against £156,680 in April and £167,124 in March.

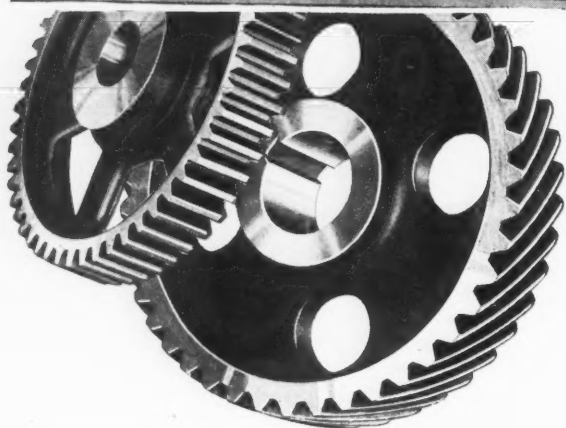
The import tonnage also showed a falling off, the May total being 510 tons as compared with 677 tons in April and 589 tons in March. The May figure was the lowest recorded since August of last year. The value of imports during May was £87,760 as against £108,649 in April and £111,985 in March. Considering the first five months of the year, exports show a slight improvement compared with the years 1925-1927.

The fall in imports during May still leaves the total of the current year far ahead of previous records, with a rising ton-value, which implies that all imports are selling and going into use.

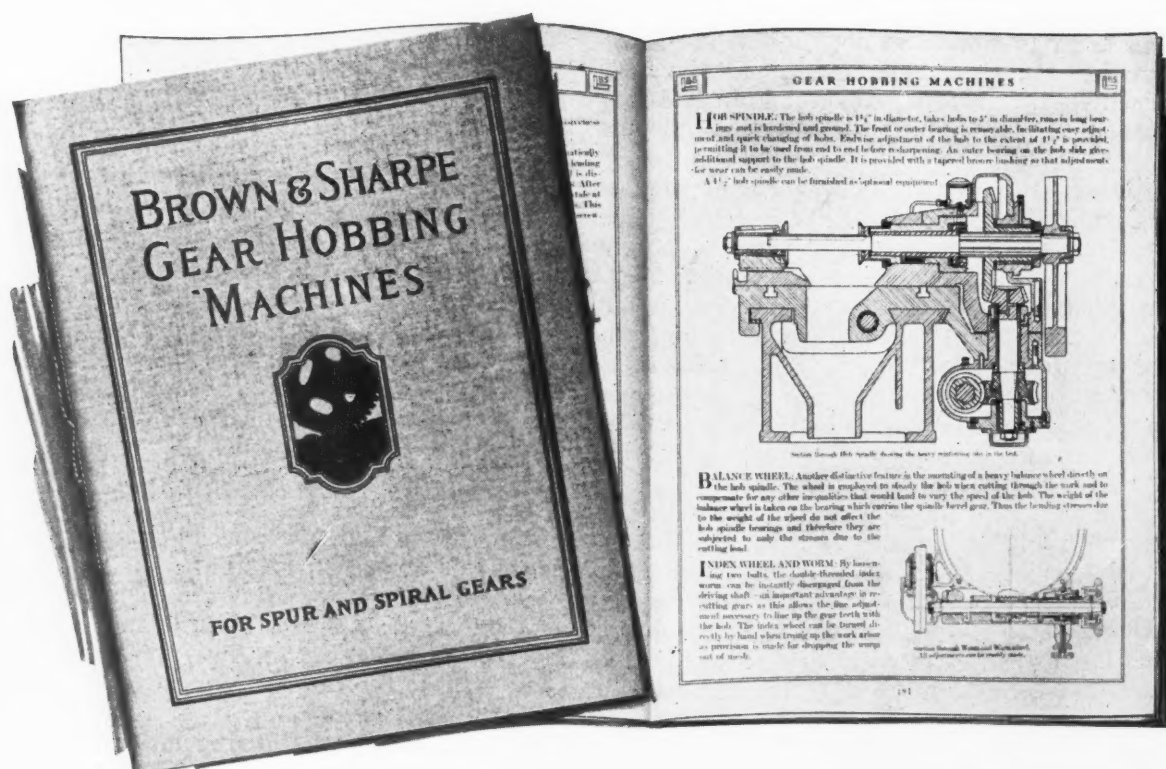
## The Shipbuilding Industry Books New Orders

It is interesting to learn that Harland & Wolff Ltd., Belfast, has received instructions to proceed with the construction of a mammoth passenger liner for the White Star Line. The actual dimensions of the vessel are not available, but when completed it will be the largest afloat. It is anticipated that it will be 1000 feet long and have a gross tonnage of 60,000. From three to four years will be required for the construction and the cost will be approximately £7,000,000. No information is available as to the type of propelling machinery to be installed. If internal combustion engines are adopted, it will mean machinery of tremendously increased size and power to anything previously attempted with this form of ship propulsion. The opinion has been frequently expressed of recent years that the day of the very large liner was over, but it would appear that so far from this being the case, the economic limit of size has not yet been reached.





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Any manufacturer whose work involves spur or spiral gear production and who is interested in lower costs should have this booklet. Write for a copy today.

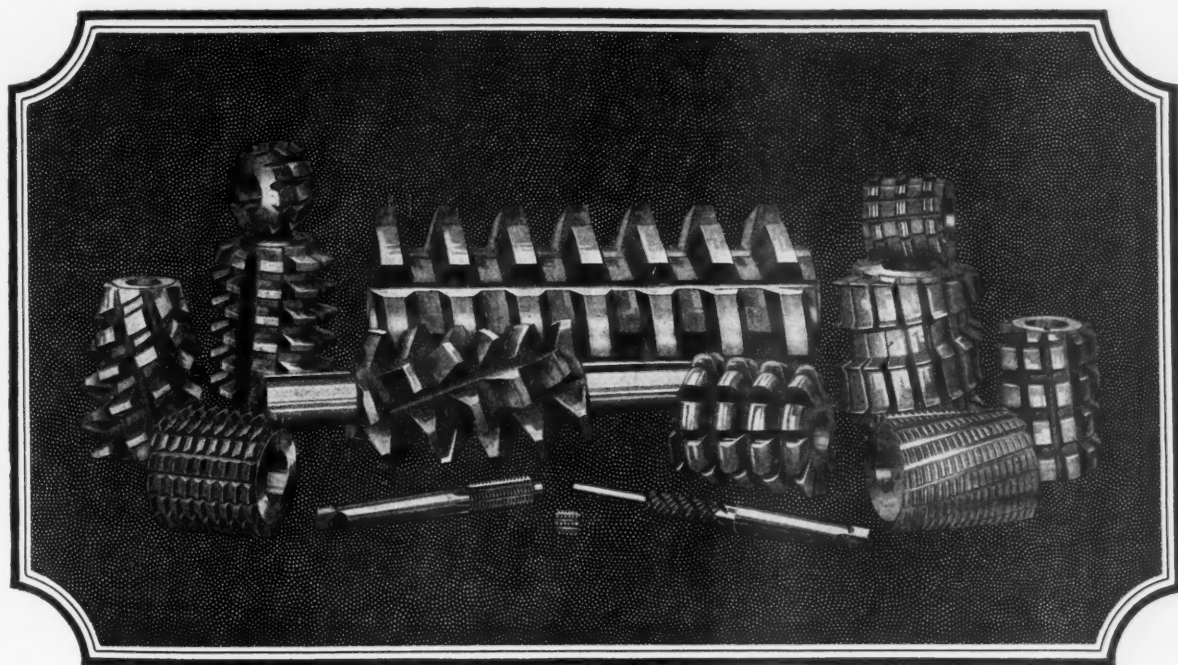
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## STANDARDIZED TOOL-HOLDER SHANKS

The Technical Committee on the Standardization of Tool-holder Shanks and Toolpost Openings of the American Society of Mechanical Engineers has completed its work, and copies of the proposed standards are now available. Those interested in the subject may obtain copies from the American Society of Mechanical Engineers, 29 W. 39th St., New York City, and if, upon receiving the standardization proposal, they have any comments or criticisms to make, they are invited to write to the chairman of the committee, Paul Mueller, Hartford Machine Screw Co., 476 Capitol Ave., Hartford, Conn.

\* \* \*

## BUILDING-UP PISTON DIAMETERS

After a period of use, the cylinders of steam pumps frequently wear out of round and it is necessary to rebores the cylinders. After re boring, the original pistons no longer fit tightly and it is necessary to replace them, unless through some means the piston diameter can be increased. According to *Oxy-Acetylene Tips*, published by the Linde Air Products Co., an oil company on the Pacific Coast uses the following method for enlarging pistons:

The pistons used by the company vary from 20 to 52 inches in diameter. By means of oxwelding, the pistons are built up on the surface by adding a 1/4-inch layer of manganese bronze. The entire face of the piston is built up at one time, the piston being slowly turned as the work progresses. One complete revolution of the piston completes the job. The method of building-up pistons with manganese bronze is now standard practice with this company. Recently a large steam pump was overhauled and the cylinders rebored. Two 20-inch and two 36-inch solid pistons were dismantled and built up with manganese bronze while the cylinders were being rebored.

\* \* \*

## TENTH ANNIVERSARY OF THE AIR MAIL

It is ten years ago this summer since the first regular air mail service in the United States was started between New York and Washington. In August, 1923, complete air mail service between New York and San Francisco was established, and in July, 1925, both day and overnight service between New York and Chicago was inaugurated. At the present time, there are twenty-two routes in operation, covering a total mileage of 9916 miles. Every day mail pilots fly a distance of over 22,000 miles, carrying mail averaging 5700 pounds. Three mail routes are now under contract which will add over 1700 miles to the system, and four additional routes with a mileage of 2300 miles are being planned, with prospects of being in operation within the next six or eight months.

\* \* \*

According to a statement published by the Bureau of Mines, the world's production of aluminum in 1927 reached over 200,000 tons, of which the United States produced 71,500 tons, and Germany, 31,250 tons. Canada produced close to 27,000 tons; Norway, slightly over 20,000 tons; and France and Switzerland, nearly the same amount each.

## OBITUARY

MALACHI J. GOOLEY, president of Gooley & Edlund, Inc., Cortland, N. Y., manufacturers of machine tools and other shop equipment, was killed in an automobile accident July 14. Mr. Gooley was sixty-three years of age and has been connected with manufacturing enterprises in Syracuse and Cortland, for many years past.

## PERSONALS

VERNER J. SWANSON, designer of the "Lever-Motor," is on a one-year leave of absence as chief engineer of the A. L. Powell Power Co., Inc., Oak Park, Ill.

FRANCIS A. EMMONS, sales and advertising manager of Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill., has been elected president of the Engineering Advertisers Association of Chicago.

ROBERT L. BROWNE, 1425 Statler Office Building, Boston, Mass., has been appointed district sales representative of the Swift Electric Welder Co., Detroit, Mich., for the state of New York and the New England States.

L. E. BUGBEE, formerly vice-president of the Cadillac Machinery Co., 6209 Hamilton Ave., Detroit, Mich., dealers in metal-working machinery, has left the company. He has not as yet announced his plans for the future.

BLAKE R. VANLEER, assistant professor of mechanical engineering at the University of California since 1920, has been appointed assistant secretary of the American Engineering Council, succeeding A. C. Oliphant, who has resigned.

R. W. HOYT, who was formerly with Alfred Gardner & Co., recently joined the sales organization of Foote Bros. Gear & Machine Co. Mr. Hoyt will cover the territory on the south side of Chicago, extending from Roosevelt Road south to 63rd Street.

J. E. HALL, who has been connected for sixteen years with the Hill, Clark & Co., machinery dealers of Boston, Mass., and later with their successors, the Stedfast & Roulston, Inc., is now with the Triplex Machine Tool Co., 50 Church St., New York City, as machine tool salesman.

WILLIAM R. STRICKLAND, assistant chief engineer of the Cadillac Motor Car Co., Detroit, Mich., has been nominated for president of the Society of Automotive Engineers. Mr. Strickland is now first vice-president of the society and chairman of the Technical Program Committee.

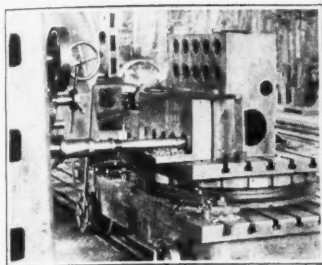
E. H. GERBERDING has been promoted to the position of assistant treasurer of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. As a 17-year-old boy he began work in the company's treasury department twenty-eight years ago, and has been continuously employed in the same department since that time.

T. A. BRYSON, who for fifteen years has been chief engineer of the Tolhurst Machine Works, Troy, N. Y., and who in that capacity has designed the many varied types of centrifugal machines manufactured by the company, has been appointed general manager to succeed C. H. Foster, who for more than twenty years has filled that position with the Tolhurst Machine Works and who has left the company to engage in other activities.

HENRY GARDNER, formerly consulting engineer with the Steamotor Co., Chicago, Ill., is now associated with the Comtor Co., Waltham, Mass., as vice-president and treasurer, and will devote his time in introducing the Comtor system in the industries engaged in interchangeable manufacturing by modern precision methods. Mr. Gardner is a graduate of the Massachusetts Institute of Technology and was for a number of years special mechanical engineer on the Baltimore & Ohio Railroad.

J. W. CLIFF has become production manager of the MacGregor Valve Co., St. Louis, Mo. Mr. Cliff has formerly held important executive and engineering positions with the Power Accounting Co., Hyatt Roller Bearing Co., Wright-Martin Aircraft Co., Lehigh Accounting Co. and Weston Instrument Co., and for the last five years he has been shop superintendent of the Merco Nordstrom Valve Co. The MacGregor Valve Co. is having machines installed for quantity production of MacGregor rotary valves under his direction.

## Typical Performance

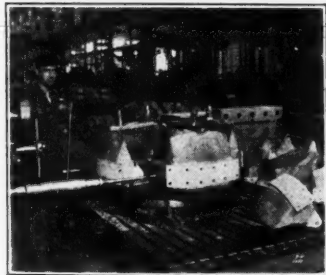


Total time including setting 150 hours, 42 min.

Pump Body for 24,000 Bbl. Oil Pipe Line  
Pump Machine clamped on 4 ft. Turn Table.  
Material: Open Hearth Steel 1.30% Carbon.  
Size: 23" x 29 1/2" x 36 1/2".  
Weight: 5700 lbs.

Drill & Tap—	10	Holes	1 1/4"	dia.	x	1 1/2"	deep
"	12	"	1 1/4"	"	x	1 3/8"	"
"	80	"	1"	"	x	1 1/4"	"
"	38	"	7/8"	"	x	1 1/4"	"
"	18	"	3/4"	"	x	1"	"
"	Bore	1	3 1/2"	"	x	36 1/2"	"
"	"	5	3 1/2"	"	x	26"	"
"	"	5	3 1/2"	"	x	10"	"
"	"	20	4"	"	x	7 1/2"	"
"	"	10	2 3/4"	"	x	2"	"
"	"	10	2 1/4"	"	x	4"	"
(See note A)							
"	20	"	3 1/4"	"	x	2 1/2"	"
"	1	"	8 1/2"	"	x	33 1/4"	"

Note "A"—These holes were drilled at different angles to the horizontal and vertical planes which required six different angular settings of the table.



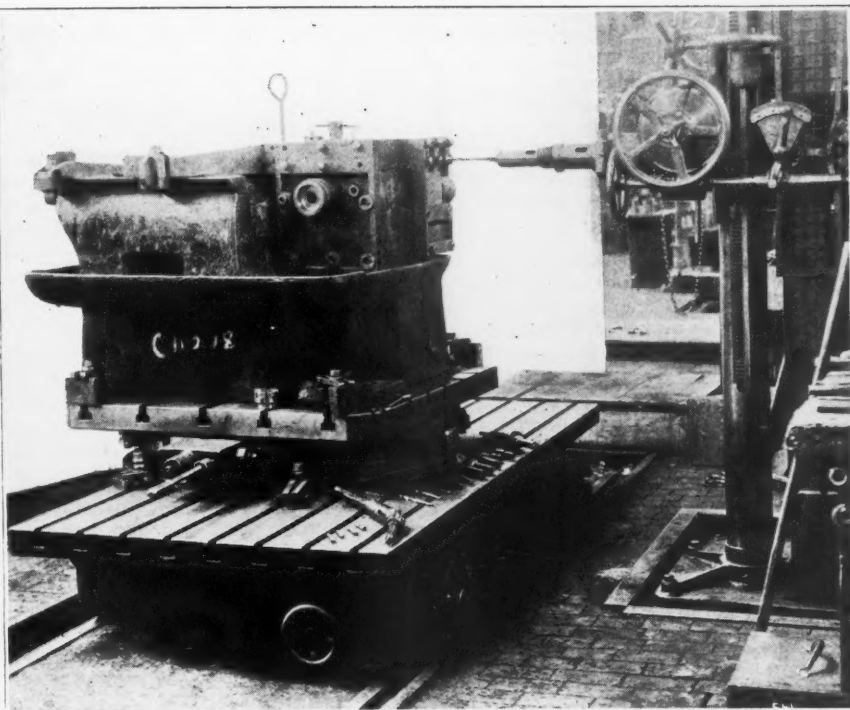
**20 BUCKETS DRILLED IN 14 1/4 HOURS**  
Floor to Floor Time  
Every Pair of Holes at a Different Angle

Four ditcher buckets, each weighing 85 pounds, mounted on a 4' turntable. Twelve 13/16" holes drilled thru 1 1/4" material. Two 1" holes drilled thru 3/4" material. Drilled from 8 positions with one clamping.



**DRILLING JACK SHAFT**

A number 1 Ryerson Horizontal drilling a 1" hole 36" deep and a 1" hole 15" deep in Hyten steel 45 carbon. Jack shaft weighing 225 pounds mounted on turntable with special automatic jig for quick movement of shaft.



## Big Saving in Total Time

### Drill Four and Five Sides of a Job From the One Set-up

**C**UT your floor-to-floor time. Drill the entire job—four sides—from the one setting, on a simple rotary table.—Or drill five sides with a universal tilting and revolving table. One set-up will handle it all.

The set-up job is easier too. The worktable is at the side of the drill with no overhanging parts to interfere. The Horizontal Method of drilling permits setting the piece upright, making the job much simpler.

Drilling, too, is faster and cleaner. Drilling pressure is against a heavy vertical column. The chips fall away from the hole, keeping the drill clean.

The Ryerson Horizontal is saving time on all types of work. It can do the same for you.

Write for Complete Information, Specifications, and Prices. Ask for Bulletin A-4051.

**JOSEPH T. RYERSON & SON INC.**

ESTABLISHED 1842

Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Pittsburgh, Philadelphia, Boston, Jersey City, New York, Richmond, Dallas, Tulsa, Los Angeles, San Francisco, Denver, Minneapolis, Duluth

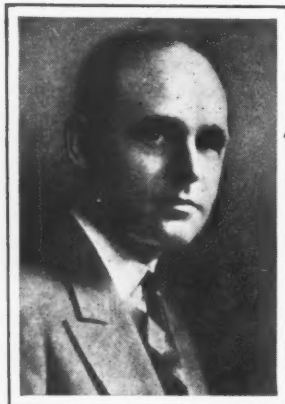
# Drill it Horizontally



MAURICE A. OUDIN, vice-president of the International General Electric Co., who has returned from an extended visit in Europe, has been decorated by the King of Italy with the Order of Commander of the Crown. This decoration is a high honor which is but rarely bestowed upon a man who is not an Italian citizen. Mr. Oudin has been active in promoting technical and industrial relations between Italy and the United States, especially in making available to Italian engineering graduates the advantages of education and training in this country.

W. C. GOODWIN, formerly section engineer of the control engineering department, has been appointed manager of the renewal parts engineering department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Mr. Goodwin graduated in 1915 from the Pennsylvania State College with the degree of Bachelor of Science in electrical engineering. Following his graduation, he entered the graduate student's course of the Westinghouse company and in 1917 was assigned to the control engineering department on design work. In 1922 he was appointed section engineer on apparatus development in that department.

THOMAS B. FRANK, treasurer of the Cincinnati Planer Co., Cincinnati, Ohio, who, as mentioned in July MACHINERY, has just been elected a member of the Board of Directors of the National Association of Cost Accountants at its annual convention in New York City, was previously president of the Cincinnati Chapter of the National Association of Cost Accountants, which chapter under his direction achieved the distinction of winning the Stevenson Trophy for chapter excellency. His term of office on the board of directors is for three years. J. THOMAS OTTO, assistant comptroller of the Cincinnati Milling Machine Co., Cincinnati, Ohio, will succeed Mr. Frank as president of the Cincinnati Chapter.



Thomas B. Frank

has been connected with the company for twenty-four years, serving first as treasurer for twenty years, and for the past four years as vice-president. During this entire period he has also acted as general manager of the company's business while located first in Hartford, Conn., and later at the present plant in Manchester, Conn. Mr. Simon is a native of Youngstown, Ohio, but has been located in the East since 1904.

GEORGE SMITH has become vice-president of Hanson-Van Winkle-Munning Co., Matawan, N. J., manufacturer of electroplating and polishing equipment and supplies. Mr. Smith will be in charge of the company's activities in the central and western states. He is a New Englander by birth and first worked for the General Electric Co., at Lynn, Mass., being later transferred to the Sprague Division, where he acted both as designing and commercial engineer. In 1922 he joined A. P. Munning & Co., taking charge of automatic electroplating installations and directing the designing of such equipment. The following year he joined Roth Brothers & Co. of Chicago, Ill., as vice-president and general manager, where among other types of electrical equipment, the Optimus electroplating generator was made under contract for A. P. Munning & Co.

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## TRADE NOTES

REMINGTON RAND, INC., Ilion, N. Y., announces that the general purchasing department of the company is now located in the Remington Rand Building, 465 Washington St., Buffalo, N. Y. L. Rayburn is director of purchases.

EDGAR ALLEN STEEL CO., INC., manufacturer of high-speed, carbon, and alloy tool steels, announces that beginning with July the address of the company's office in New York will be 741 Washington Street; and in Chicago, 21 N. May St.

MAGNETIC MFG. CO., Milwaukee, Wis., manufacturer of magnetic equipment, announces the opening of a direct factory branch office at 211 N. Desplaines St., Chicago, Ill. All business for Chicago and vicinity pertaining to magnetic equipment problems will be handled from this office in the future.

UNITED STATES ELECTRICAL TOOL CO., 2477 W. Sixth St., Cincinnati, Ohio, has appointed T. H. Scaffé district manager of the Detroit branch. R. N. Brayer has been added to the personnel of this branch. Mr. Scaffé has been connected with the Detroit branch for some time, while Mr. Brayer was previously with the Boyer-Campbell Co. of Detroit for a number of years. Both men have a thorough knowledge of electrical tools and machines through years of experience with such equipment.



T. H. Scaffé

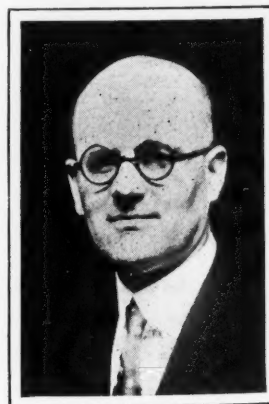
COGSBILL MFG. CO., Detroit, Mich., manufacturer of metal cutting tools, is constructing a modern fireproof addition to the factory for use as a stockroom. Increase in business has necessitated this addition, which will make possible the carrying of substantial stocks.

GISHOLT MACHINE CO., Madison, Wis., entertained the Chicago Superintendents and Foremen's Club of the National Metal Trades Association on June 23. The group numbered about 250 men, who went to Madison by special train. They first inspected the Gisholt Machine Co.'s plant and later that of the Madison-Kipp Corporation.

LUEHRS CO., industrial engineers, designers and builders of production machinery, has moved into its new plant at Fostoria, Ohio, where greatly increased manufacturing facilities will be available. The new plant has 40,000 square feet of floor space, 28 feet head-room in the erecting bay, and is located on a private railroad siding.

CLEVELAND DUPLEX MACHINERY CO., INC., Penton Building, West 3rd and Lakeside Ave., Cleveland, Ohio, has been appointed exclusive agent in the Northeastern Ohio territory for the Grant Mfg. & Machine Co., Bridgeport, Conn., for the sale of Grant rivet spinners, vibrating riveters, double-end threading and chamfering machines, and special machinery.

ROLLER-SMITH CO., 233 Broadway, New York City, maker of electrical instruments and circuit breakers, announces the following changes in its sales organization: The state of Texas is now handled by John A. Coleman, 1006 Washington Ave., Houston, Tex.; Colorado, Utah, Wyoming and Northern New Mexico are now being handled by H. T. Weeks, U. S. National Bank Building, Denver, Colo.



R. N. Brayer

BROWN INSTRUMENT CO., Philadelphia, Pa., maker of pyrometers, thermometers, flow meters, and indicating and recording instruments, is building another addition to its plant. The new structure will be 60 by 44 feet, two stories in height. The foundation will permit other floors to be added as future requirements demand. The primary purpose of the new building, which is the third that the company is adding within eight years, is to provide research facilities.

D. S. MAIR MACHINERY CO., 505 Esperson Building, Houston, Texas, has been formed by D. S. Mair, who was for seventeen years in charge of the Houston office of Joseph T. Ryerson & Sons, Inc. The object of the new company is to handle a complete line of machine tools, including Landis bolt and pipe threading machines and Victor collapsible taps. The company solicits correspondence with machine tool builders who wish to be represented in the Houston territory and desires particularly to obtain the agency for a high-grade line of engine lathes.

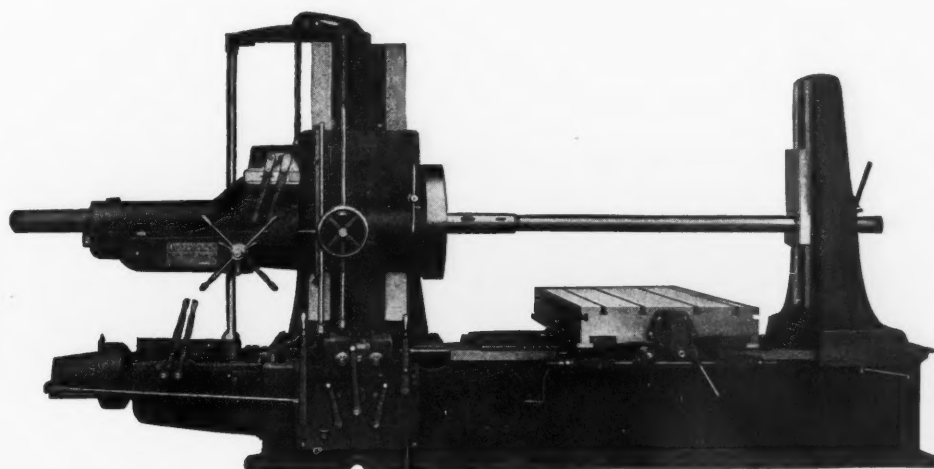
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## An Excellent Overflow Machine

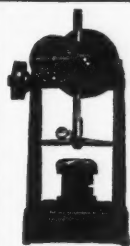
As your boring, milling and drilling departments become crowded, from time to time, take care of the peak load in all of them, successively and successfully with a LUCAS

# "PRECISION"

Boring, Drilling and Milling Machine



Holes may be bored and surfaces milled at a single setting and their accurate relation assured, without the necessity of expensive jigs.



WE ALSO MAKE THE  
**LUCAS POWER**  
Forcing Press

**THE LUCAS MACHINE TOOL CO., Cleveland, Ohio, U.S.A.**

FOREIGN AGENTS: Alfred Herbert, Ltd., Coventry, Societe Anonyme Belge, Alfred Herbert, Brussels. Allied Machinery Co., Barcelona, Zurich. V. Lowener, Copenhagen, Oslo, Stockholm. R. S. Stokvis & Zonen, Paris and Rotterdam. Andrews & George Co., Tokyo, Ing. M. Kocian & G. Nedela, Prague. Emanuele Mascherpa, Milan, Italy.

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FAFNIR BEARING Co., New Britain, Conn., has contracted for the erection of a new one-story building 120 by 60 feet and for a 60-foot addition to an existing six-story wing of the present factory. The new building will house a thoroughly modern hardening department for which new equipment will be provided. The six-story addition will enlarge the working capacity of several of the manufacturing departments and enable them to handle a larger volume of business more adequately. Plans are also under way for the construction of still another six-story building.

DETROIT PISTON PIN & MFG. Co., Grand Haven, Mich., announces that the name of the company has been changed to Ottawa Steel Products, Inc. The old name has caused some confusion since the firm moved to Grand Haven from Detroit last fall. The name Ottawa is the name of the county where the firm is now located; Steel Products is more descriptive of the nature of the business than the old name, although piston pins continue to be the leading item, as it has been since the firm was founded in 1922. Centerless ground parts continue to be a specialty. The factory has been operating on a 60-hour a week basis since January, in addition to the employment of a night force.

VAN DORN ELECTRIC TOOL Co., Cleveland, Ohio, announces that the company's sales branches in Los Angeles, San Francisco and Seattle and the service branches in Los Angeles, Oakland and Seattle have been supplemented by the establishment of a complete warehousing and service depot at 525 E. 10th St., Oakland, Calif. A complete stock of both Van Dorn and Van Norman products will be carried in this

warehouse and all Pacific Coast shipments will be made directly from that point. The sales departments will be operated separately, being located as follows: 857 S. San Pedro St., Los Angeles, Calif.; 75 Fremont St., San Francisco, Calif.; 514 Virginia St., Seattle, Wash.

OLIVER MACHINERY Co., Grand Rapids, Mich., manufacturer of woodworking machinery and machine tools, has purchased the business of Butterworth & Lowe of Grand Rapids, a long established firm that has specialized in the building of band saws for cutting logs, machinery for the stone industries, rock crushers and equipment for gypsum mills and mines. The Oliver Machinery Co. will continue all of these lines and will make improvements and additions to them. A few years ago the company purchased the business and building of the firm of Baldwin-Tuthill & Bolton, manufacturers of saw and knife-fitting machinery, as well as the business and property of the Grand Rapids Foundry Co.

MANNING, MAXWELL & MOORE, INC., 100 E. 42nd St., New York City, has purchased the American Schaeffer & Budenberg Corporation of Brooklyn, N. Y., and Worcester, Mass. The newly acquired company, founded in 1851, is the oldest and one of the largest manufacturers of industrial instruments in the United States. The business of the company will be coordinated with that of the Consolidated Ashcroft Hancock Co., Inc., manufacturer of valves and indicating and recording instruments, already owned by Manning, Maxwell & Moore, Inc. The operation of the Brooklyn and Worcester factories of the American Schaeffer & Budenberg Corporation will be taken over at once by Manning, Maxwell & Moore, Inc.

## COMING EVENTS

AUGUST 27-29—Regional meeting of the American Society of Mechanical Engineers at St. Paul-Minneapolis, Minn. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

AUGUST 29-SEPTEMBER 3—Eleventh Annual Conference on Human Relations in Industry at Silver Bay, Lake George, N. Y. Fred H. Rindge, Jr., executive secretary, 347 Madison Ave., New York City.

SEPTEMBER 4-7—Canadian Steel and Power Show, University of Toronto Arena, Toronto, Ontario, Canada. Campbell Bradshaw, secretary, 24 Front St. West, Toronto.

SEPTEMBER 5-22—Fourth Machine Tool and Engineering Exhibition to be held at Olympia, London, England.

SEPTEMBER 12-14—Annual convention of the American Railway Tool Foremen's Association in Chicago, Ill.; headquarters, Hotel Sherman. Secretary and treasurer, F. A. Armstrong, 564 W. Monroe St., Chicago, Ill.

SEPTEMBER 17-20—Second national meeting of the Fuels Division of the American Society of Mechanical Engineers to be held in Cleveland, Ohio. Chairman of Fuels Division, Victor J. Azbe, American Society of Mechanical Engineers, 29 W. 39th St., New York City.

SEPTEMBER 24-27—National Machine Shop Practice meeting of the American Society of Mechanical Engineers in conjunction with the Cincinnati Section of the society, L. C. Morrow, Tenth Ave. and 36th St., New York City, chairman of the Machine Shop Practice Division of the A.S.M.E.

OCTOBER 8-12—Annual convention of the American Society for Steel Treating at Benjamin Franklin Hotel, Philadelphia, Pa. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

OCTOBER 8-12—Annual meeting of the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers at Benjamin Franklin Hotel, Philadelphia, Pa. W. M. Corse, secretary, 810-18th St., N.W., Washington, D. C.

OCTOBER 8-12—Fall meeting of the American Welding Society at Bellevue-Stratford Hotel, Philadelphia, Pa. M. M. Kelley, secretary, 33 W. 39th St., New York City.

OCTOBER 8-12—Tenth National Metal Exposition held under the auspices of the American Society for Steel Treating at the Commercial Museum, Philadelphia, Pa. For further infor-

mation, address W. H. Eisenman, National Secretary, 7016 Euclid Ave., Cleveland, Ohio.

OCTOBER 11-13—Semi-annual meeting of the American Gear Manufacturers' Association at the Hotel Statler, Buffalo, N. Y. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

NOVEMBER 13-15—Convention of the American Management Association at Palmer House, Chicago, Ill. Secretary's address, 20 Vesey St., New York City.

NOVEMBER 22-23—Production meeting of the Society of Automotive Engineers at Hotel Book-Cadillac, Detroit, Mich. Chairman of Technical Program Committee, E. P. Blanchard, Bullard Machine Tool Co., Bridgeport, Conn.

DECEMBER 3-7—Annual meeting of the American Society of Mechanical Engineers to be held in the Engineering Societies Building, New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

DECEMBER 3-8—National Exposition of Power and Mechanical Engineering in the Grand Central Palace, New York City.

JANUARY 14-18, 1929—Western Metal Congress and Western States Metal and Machine Tool Exposition at Los Angeles, Cal., under the auspices of the American Society for Steel Treating; headquarters, Shrine Auditorium. Secretary, W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio.

## NEW BOOKS AND PAMPHLETS

A STUDY OF SPONTANEOUS COMBUSTION IN STORAGE COAL. By A. J. Hoskin. 61 pages, 6 by 9 inches. Published as Bulletin No. 30 by the Engineering Experiment Station of Purdue University, Lafayette, Ind.

A PRECISION VALUE FOR THE INCH. By Luther D. Burlingame. 9 pages, 6 by 9 inches. Published by the American Institute of Weights and Measures, 115 Broadway, New York City.

This paper contains a brief and concise but complete statement in regard to the inch as a unit of measurement and contains a proposal for a definition of the inch which would be equally acceptable to the United States, Great Britain, Canada and the other British commonwealths.

SPRINGS. By Piero Gradenigo. In four volumes with a total of 750 pages, 6½ by 10 inches. Published by S. Lattes & Co., 3 Via Garibaldi, Turin, Italy.

This is a most complete treatise in the Italian language on the theory, design and manufacture of springs. The author is Professor at the Royal School of Naval Engineering at Genoa. It is divided into four volumes covering every phase of spring design and calculation, with 442 illustrations and 54 tables. Unfortunately, being published in Italian, the information in this comprehensive work is not easily available to American engineers.

HOW TO SOLVE TYPICAL BUSINESS PROBLEMS. By William R. Basset. 223 pages, 5 1/4 by 7 1/2 inches. Published by B. C. Forbes Publishing Co., 120 Fifth Ave., New York City. Price, \$2.50.

This book, in fifteen chapters, deals with a number of the problems that face the business executive almost every day. Among the chapter headings, which will indicate the general scope of the work, are the following: Selling at a Profit, The Sound Labor Policy, The Commonsense Way to Pay Wages, Buying for Profit, Fewer Varieties Mean Lower Costs, Cutting Down the Material Cost, The Sensible Credit Policy, What the Right Cost System Can Do, Making the Factory a Tool of Production, and How Big Should a Business Be?

THE MODERN GASOLINE AUTOMOBILE. By Victor W. Page. 1148 pages, 6 by 9 inches, 746 illustrations. Published by Norman W. Henley Publishing Co., 2 West 45th St., New York City. Price, \$5.

This is the 1928 edition of the author's well-known book on the design, construction, operation and maintenance of automobiles. The present edition is in many respects an entirely new book, having been thoroughly revised, much enlarged, and entirely reset so as to include all recent improvements in automobile engineering. It contains twenty-five chapters dealing in great detail with every phase of the subject. Most of the illustrations are line engravings that show clearly the construction of all parts entering into automobile building. The book is written in as non-technical a manner as possible, considering the subject dealt with, but its completeness and the detailed explanations should make it a valuable book not only to motorists, mechanics and repair men, but also to automobile designers and engineers.

SIMPLIFIED MECHANICAL DRAWING. By Thurman C. Crook. 153 pages, 9 by 7 inches. Published by the McGraw-Hill Book Co., Inc., New York City. Price, \$1.25.

The author of this book is instructor of mechanical drawing at the South Bend Central

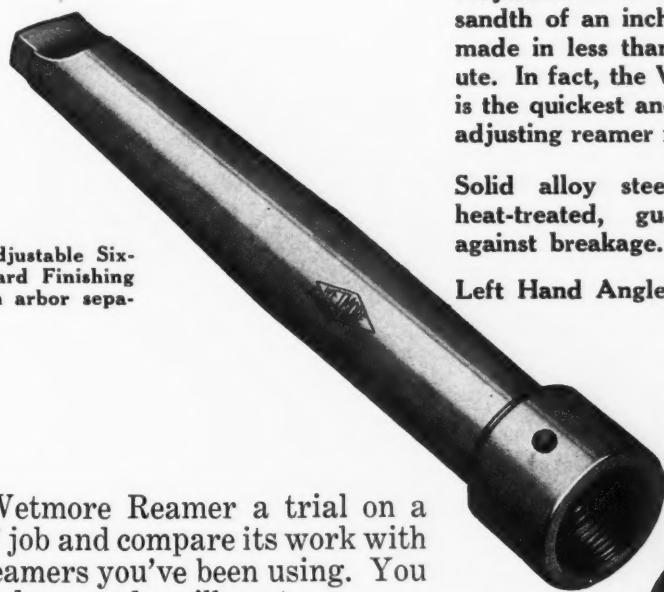
# 4 Reasons



Wetmore Adjustable Six-blade Standard Finishing Reamer with arbor integral.

## Why WETMORE Reamers Cut Production Costs

Production men in many of the largest plants are specifying Wetmore Adjustable Reamers because Wetmores have proved — on actual tests — that they do *better, more accurate work at less cost*. Here are four features that make Wetmore the reamer preferred by men who know what it can do:



Wetmore Adjustable Six-blade Standard Finishing Reamer with arbor separate.

Adjustments to the thousandth of an inch can be made in less than a minute. In fact, the Wetmore is the quickest and easiest adjusting reamer made.

Solid alloy steel body, heat-treated, guaranteed against breakage.

Left Hand Angle Cutting

Blades that prevent digging in, chattering and scoring while backing out. Shearing effect of blades increases life of cutting edge.

No grinding arbor required for regrinding. Wetmore Reamers can be reground on their original centers.

*Wetmore Blades are carried in stock for all types of Wetmore Reamers. Best high-speed steel, ground to thickness, length, and on seat. In ordering, give type and size of reamer and whether reamer is to be used on steel, cast iron, or bronze, etc.*

Give a Wetmore Reamer a trial on a good stiff job and compare its work with that of reamers you've been using. You be the judge—and we'll rest our case with you.

Send for Catalog No. 26, showing full line of Wetmore Adjustable Reamers—and reduced prices.

**WETMORE REAMER CO.**

60 27th Street, Milwaukee, Wisconsin



## ADJUSTABLE REAMERS

"THE BETTER REAMER"



Junior High School and Vocational School, South Bend, Ind. He states that the book is intended especially as a text-book in mechanical drawing for the public schools. The chief aim of this course in mechanical drawing is to teach visualization, to form habits of accuracy, and to teach the students to make good pencil drawings, as well as to read working drawings. The author points out that it has been considered impossible by many instructors to teach mechanical drawing and lettering satisfactorily to students in the upper grades of grammar schools, but he believes that with the use of a text-book such as the one under review, a general course in drawing can be given without difficulty. The problems are arranged in progressive sequence, ranging from the simpler to the more difficult, but in all cases practical projects used in the school shop work are the subjects of the drawings.

**PRINCIPLES OF VALUATION.** By John Alden Grimes and William Horace Craigue. 274 pages, 6 by 9 inches. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York City. Price, \$10.

This work, which should be of great value in all the industries where proper valuation of equipment, inventory and buildings is of importance, has been prepared by two valuation engineers of the United States Treasury Department who were formerly connected with large industrial concerns. The book describes several methods of income valuation and discusses the advantages and disadvantages of each method. The objective of the book is the development and comparison of the several mathematical principles which are used in valuation work and a discussion of these principles with respect to their applicability in everyday commercial work. Practically every aspect of the mathematical principles of valuation is covered in this book. It shows, in addition, the acceptable methods that can be used to meet federal and state income tax law requirements for valuing the income of lands, natural resources, inventories, franchises, patents, and good will. It deals with the problem of figuring future income when the valuation decreases or increases by regular amounts. Four methods used in establishing sinking funds are presented and detailed arithmetical illustrations of the application of the formulas and methods described are included. A great number of valuable tables are also found in the book.

#### NEW CATALOGUES AND CIRCULARS

**ELECTRIC EQUIPMENT.** Electric Controller & Mfg. Co., Cleveland, Ohio. Circular illustrating and describing type ZO starting switches.

**ELECTRIC CONTROLLERS.** Electric Controller and Mfg. Co., Cleveland, Ohio. Circular illustrating and describing the Dinkey controller made by the company.

**METALS SHELVING AND CABINETS.** Interlock Metal Units, Inc., 31-33 E. 27th St., New York City. Circular illustrating and describing adjustable steel shelving.

**BABBITTING MACHINE.** New Departure Mfg. Co., Bristol, Conn. Circular 187 FE, illustrating and describing a centrifugal babbitting machine for high production work.

**DROP PIT TABLES.** Watson-Stillman Co., 73 West St., New York City. Bulletin C-30, illustrating and describing the Wasco four-screw electric drop pit table for railroad shops.

**STEEL CASTINGS.** Lebanon Steel Foundry, Lebanon, Pa. Circular entitled "Castings that Must Never Fail," illustrating and describing electric steel castings used in rock drill equipment.

**MILLING MACHINES.** Kearney & Trecker Corporation, Milwaukee, Wis. Circular giving a number of views of the company's factory and also illustrating the types of milling machines built.

**STEAM TURBINES.** Murray Iron Works Co., Burlington, Iowa. Bulletin T-100, illustrating and describing Murray standard steam

turbines, giving complete details with numerous sectional drawings.

**PUMPS.** Ingersoll-Rand Co., 11 Broadway, New York City. Catalogue of Cameron multistage centrifugal pumps, containing illustrated description of these pumps and showing a number of installations.

**BALL BEARINGS.** New Departure Mfg. Co., Bristol, Conn. Booklet entitled "More and Better Production at Less Cost," containing an illustrated treatise on "What Ball Bearings Mean to Machine Tools."

**WELDED PIPE.** Linde Air Products Co., 30 E. 42nd St., New York City. Booklet entitled "Oxwelded Industrial Piping," illustrating and describing installations of such pipe and the methods by which the welding is done.

**MILLING CUTTERS.** Goddard & Goddard Co., Detroit, Mich. Special catalogue of new standardized shell end mills, arbors, collet holders and collets. The catalogue illustrates the different tools and gives tables of dimensions.

**BALL BURNISHING BARRELS.** Abbott Ball Co., 1045 New Britain Ave., Hartford, Conn. Circular illustrating and describing Abbott ball burnishing barrels for finishing metal parts all the way from tiny threaded screws to large castings.

**NICKEL STEEL AND NICKEL IRON CASTINGS.** International Nickel Co., 67 Wall St., New York City. Pamphlet No. 12, on alloy steel for boiler construction. Also circulars covering increased strength and increased hardness of nickel iron castings.

**PATTERNMAKING AND WOODWORKING MACHINERY.** Crescent Machine Co., 56 Main St., Leetonia, Ohio. Catalogue illustrating and describing a varied line of portable woodworking machines for pattern shops and woodworking shops in general.

**SPROCKETS AND CHAINS.** Boston Gear Works Sales Co., Norfolk Downs, Mass. Catalogue 7-28 entitled "Sprockets and Chains," containing information and specifications relating to the different types of chains and sprockets carried in stock by the company.

**ELECTRIC EQUIPMENT.** General Electric Co., Schenectady, N. Y. Bulletins illustrating and describing direct-current mill motors, squirrel-cage induction motors, travel carriage for automatic arc welders, magnetic switches, and resistor units for cable reel motors.

**TAPPING MACHINES.** Industrial Machine Co., 330 S. Dearborn St., Chicago, Ill. Circulars illustrating and describing tapping machines with new friction drive mechanism for eliminating breakage of taps. These machines can be arranged for either belt or motor drive.

**SPEED REDUCERS.** D. O. James Mfg. Co., 1120 W. Monroe St., Chicago, Ill. Circular illustrating and describing the James direct drive planetary spur gear speed reducer and showing numerous applications of these speed reducers, which are made in all types and sizes up to 1000 H.P.

**POWER PRESSES.** American Can Co., Equipment Division, 120 Broadway, New York City. Circulars illustrating and describing "Canco" toggle presses, arch presses, screw presses, and horn and apron presses, giving full information and specifications of the different sizes manufactured.

**VALVE FINISHING EQUIPMENT.** Willis-Jones Machinery Co., Inc., Seattle, Wash. Catalogue No. 2, illustrating and describing valve reseaters, giving complete information on all the special tools used in connection with the reseater, and covering also valve guide boring and replacement valve seats.

**TURRET LATHES.** Gisholt Machine Co., Madison, Wis. Catalogue H.P. 1, illustrating and describing the company's No. 1L and 2L high production turret lathes. Complete specifications are given and accessories and standard tool equipment are listed in detail. The catalogue is completely illustrated with both halftones and line engravings.

**GEAR HOBBING MACHINES.** Schuchardt & Schutte—George Scherr Co., exclusive representatives for the United States—144 Liberty St., New York City. Catalogue T-926, illustrating and describing automatic gear hobbing machines for spur, worm and spiral gears, together with information relating to the hobs and tools used in connection with them.

**MACHINE TOOLS.** Niles-Bement-Pond Co., 111 Broadway, New York City. Booklet entitled "On Land, on Water, in the Air," illustrating and describing different types of machine tools, metal-cutting tools, and cranes built by the company and especially applicable to shops in the transportation field—railroad shops, automobile plants, and airplane engine shops.

**ELECTRIC WELDING.** Lincoln Electric Co., Cleveland, Ohio. Engineering bulletin No. 206, "Arc Welding Equipment." The subject matter of the bulletin is "Variable-voltage, Single Operator versus Constant-potential, Multiple Operator." The booklet, which is written from the engineering point of view will interest executives, engineers and welder operators.

**PRESSES.** Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. Bulletin No. 64-C, illustrating and describing double crank power presses in a great many sizes, models and capacities. Bulletin No. 68, illustrating and describing foot presses and screw presses. Both bulletins give complete specifications of the different lines of machines described.

**GRINDING MACHINES.** Thompson Grinder Co., 1534 W. Main Street, Springfield, Ohio. Bulletin No. 18 illustrating and describing the Thompson 12- by 36-inch universal grinding machine which may be driven either by separate countershaft or by motor. The bulletin illustrates and describes all standard and special features and also gives instructions for setting-up the machine.

**WELDING AND CUTTING EQUIPMENT.** Oxweld Acetylene Co., 30 E. 42nd St., New York City. Catalogue illustrating and describing the products manufactured by the company, including welding and cutting equipment and generators for the production of acetylene. Among the new products included are a new type cutting blowpipe, a portable low-pressure acetylene generator, and flood lights.

**HOISTS.** Union Mfg. Co., New Britain, Conn. Catalogue of Union hoists, illustrating and describing the new features and advantages of this line of hoists which includes spur geared hoists, Acme quick-acting hoists, and differential hoists, as well as roller-bearing steel side-plate trolleys. Among the improved features of these hoists may be mentioned roller bearings, alloy steel cut gears, improved hooks, all-steel suspension, and visible self-closing and self-cleaning oilers.

**CHUCKS.** Union Mfg. Co., New Britain, Conn. Catalogue No. 60, illustrating and describing manually-operated chucks for all classes of work and for every type of machine tool. The catalogue contains a great deal of information not included in previous catalogues. A number of chucks which have been added to the line manufactured by the company and not previously shown are included in the present catalogue. There is also more dimensional information than has formerly been included. The catalogue covers 64 pages and is profusely illustrated with both halftones and line engravings.

**JIG BORING MACHINES.** R. Y. Ferner Co., Investment Building, Washington, D. C., representative in the United States of the Societe Genevoise d'Instruments de Physique of Geneva, Switzerland. Pamphlet 1001 entitled "Questions to Ask Before Buying a Jig Boring Machine," containing eighty questions and answers relating to jig boring equipment, divided under the headings: General arrangement, measuring devices, measuring screws and automatic correctors, boring spindles, laying out and measuring work, accuracy, circular dividing tables, special tools and boring methods, and installation. The equipment furnished by the company is also illustrated and described in the answers.

# MACHINERY

DESIGN — CONSTRUCTION — OPERATION

Volume 34

AUGUST, 1928

Number 12

## PRINCIPAL ARTICLES IN THIS NUMBER

Controlling Tools in an Automotive Shop— <i>By Charles O. Herb</i> .....	889
What You Should Know about Patents— <i>By H. L. Kauffman</i> .....	893
Conveyors that Cut Handling Costs.....	897
Special Tools for Railway Shops.....	903
Current Editorial Comment.....	906
A New Era in Cutting Steels—Is Your Problem Different?	
Economical Sectional Stock Bins—Research on Cutting Lubricants—	
Does It Pay to Repair Obsolete Machines?	
The Economics of the Wage Problem— <i>By Jacob D. Cox, Jr.</i> .....	907
Electric Drives for Machine Tools— <i>By Gordon Fox and Arthur J. Whitcomb</i>	909
Ingenious Mechanical Movements.....	913
Cross-slide Milling Attachment for Automatic Screw Machine— <i>By Henry Simon</i>	916
Training Boys in a Successful Trade School— <i>By Freeman C. Duston</i> .....	917
Oxy-acetylene Welding of Brass— <i>By A. Eyles</i> .....	921
Cast-iron Dies for Forming and Bending— <i>By P. H. White</i> .....	925
Work-supporting Pins for Fixtures— <i>By Alfred M. Wasbauer</i> .....	927
Estimating Production Costs— <i>By Herbert W. Cable</i> .....	940
Taper-boring Cast-iron Cylinders.....	944
Tumbling Barrel Installation which Saves Floor Space.....	948
British Metal-working Industries.....	965

## DEPARTMENTS

What MACHINERY'S Readers Think.....	900
Notes and Comment on Engineering Topics.....	905
Letters on Practical Subjects.....	929
Shop and Drafting-room Kinks.....	937
Questions and Answers.....	938
New Machinery and Tools.....	949

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Advertisers Index 309-310

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# PUTNAM

## Another application of our new UNIT MILLING HEAD



### SPECIAL MILLING MACHINE equipped with new PUTNAM UNIT MILLING HEAD

The Machine illustrated was built for the H. B. Smith Company of Westfield, Mass. Using one Putnam Unit Head, 3½ in. spindle, it is equipped with 16 spindle speeds, either direction, 12 feeds for head along rail in either direction, and 12 feeds for quill. Also rapid power traverse for quill and for head along rail.

This particular Machine has a table 42 in. x 72 in., equipped with oil gear feed.

## SHAW CRANE-PUTNAM MACHINE CO. INC.

PUTNAM WORKS     FITCHBURG, MASS.

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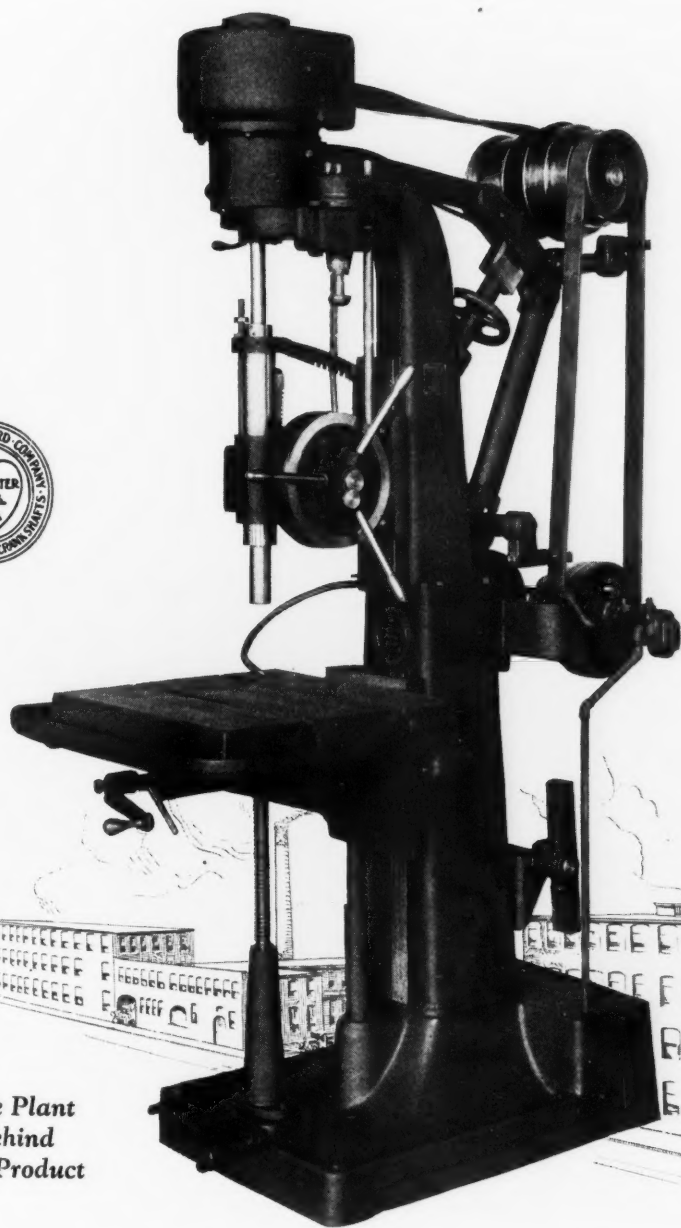
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# Leland-Gifford Drilling Machine

## with No. 3 Morse Taper



The Plant  
behind  
the Product

The steady growth of Leland-Gifford Company reflects the definite way its products have met the requirements of the machine industry.

In 25 years this plant has grown from a floor space of 500 square feet to more than 121,000 square feet.

Leland-Gifford Drilling Machine with No. 3 Morse Taper is a typical example of the products that have made this growth possible.

Leland-Gifford Company, - - Worcester, Mass., U.S.A.

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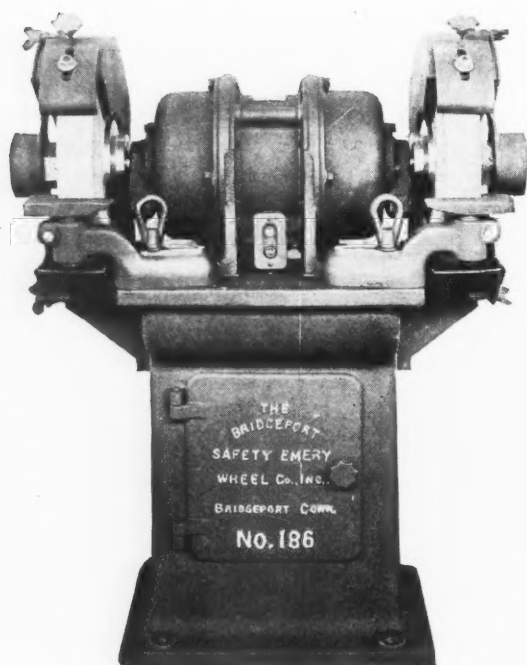


Nothing is apt to cost so much as a bearing that cost so little!

Another 1 of the  
143  
machine tool  
manufacturers  
that uses **SKF**  
bearings as  
..standard..  
equipment

*You men who plan, build, use or pay for machines of any kind, remember this: It costs more to replace a poor bearing than to buy the best one that **SKF** ever produced. AND **SKF** ANTI-FRICTION BEARINGS ARE THE HIGHEST PRICED IN THE WORLD.*

THE BRIDGEPORT  
SAFETY EMERY  
WHEEL CO.



For over Ten Years  
**SKF** Dependability  
Has Passed on to Users  
of These Grinders

UNDER all kinds of conditions—floor grinders must operate. And it is expected that they will run properly—with little or no attention. To meet these demands, the Bridgeport Safety Emery Wheel Co. has been using **SKF** Ball Bearings for over ten years because they have given the most satisfactory service. Dependability for the ultimate user has not been sacrificed to price.

On this type of grinder, **SKF** Ball Bearings serve a dual purpose—they positively locate the rotor with respect to air-gap and withstand the heavy pressures to which they are naturally subjected day after day at high speeds. The only attention **SKF** Bearings require is a replenishing of lubricant a few times a year—and that's all.

**SKF** INDUSTRIES, INCORPORATED, 40 East 34th Street, New York, N. Y.

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Ball Bearings - Roller Bearings

**SKF**





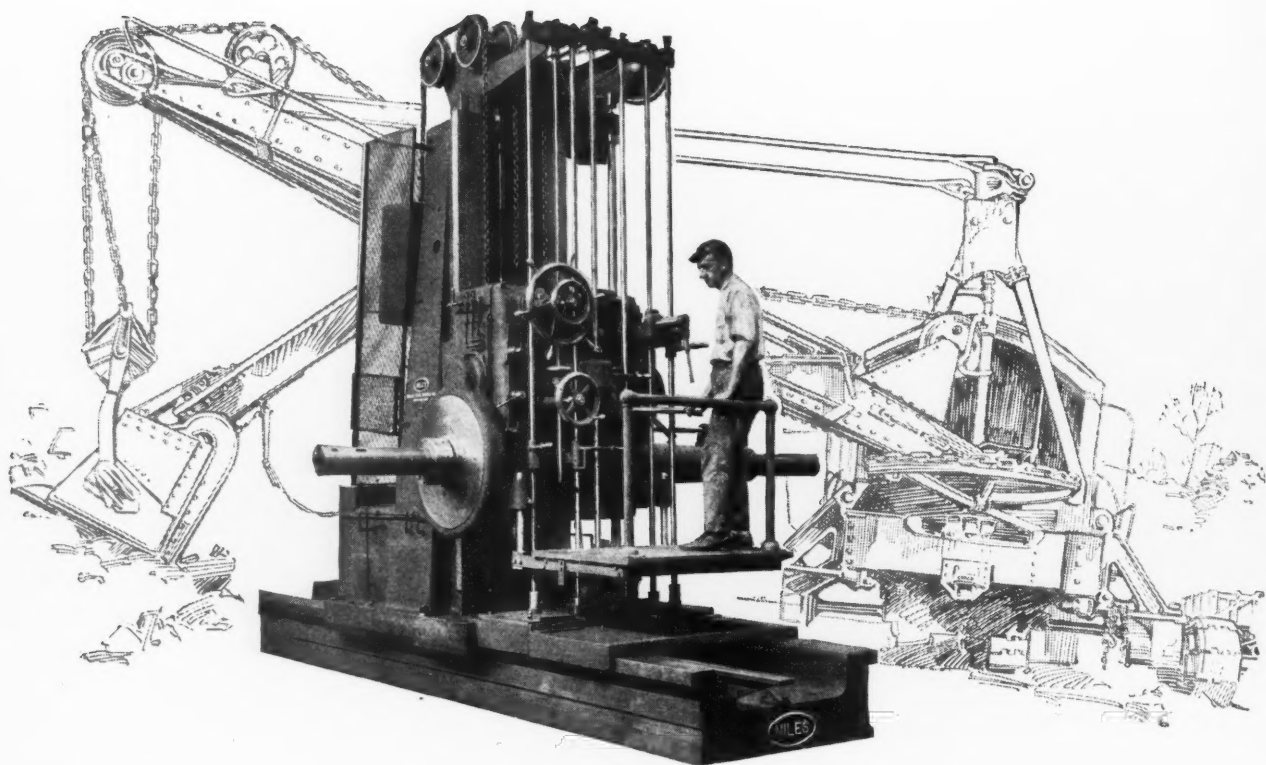
required to make adjustments on the Cincinnati Rapid Traverse Shaper. The same wrench fits them all—tool post, vise, table support, rail clamp and clapper box.

This—like the easy speed and feed changes, the new spring throughout hand feed, the automatic clamp for stroke changes, and power rapid traverse to the table—is just another one of the refinements on the Cincinnati that lessen the set up time.

You should study the many shaper refinements, exclusive to Cincinnati Shaper, described in detail in our catalog. Write for it.

THE CINCINNATI SHAPER CO., CINCINNATI, O.

**Cincinnati Shapers**  
*Rapid Traverse*



# Helps to build

## MARION STEAM SHOVELS

This Niles Floor Borer and his twin brother are in the plant where the famous Marion Steam Shovels are made.

In any shop doing large work suitable for this machine, there is nothing else that will do the job as well. A lifetime of hard service is built into the Floor Borer. Maag Gears, running in an endless cascade of oil, transmit the power smoothly, quietly and surely and lubrication to the bearings maintains the film of oil between the moving parts and insures indefinite years of efficient operation.

Men who make a steam shovel as good as the Marion do not buy machine tools in a haphazard way. Their choice of Niles Floor Borers should induce you to write to us for full construction details and specifications.

### The Niles Tool Works Company

Division Niles-Bement-Pond Company

Hamilton, Ohio

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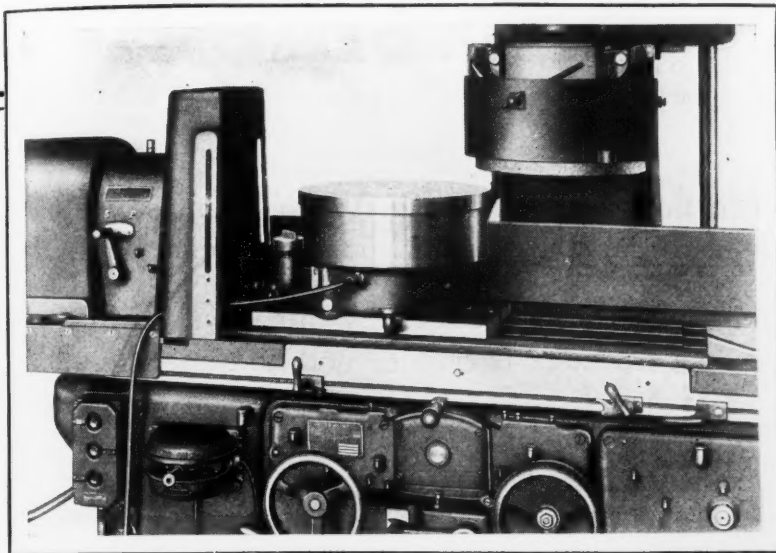
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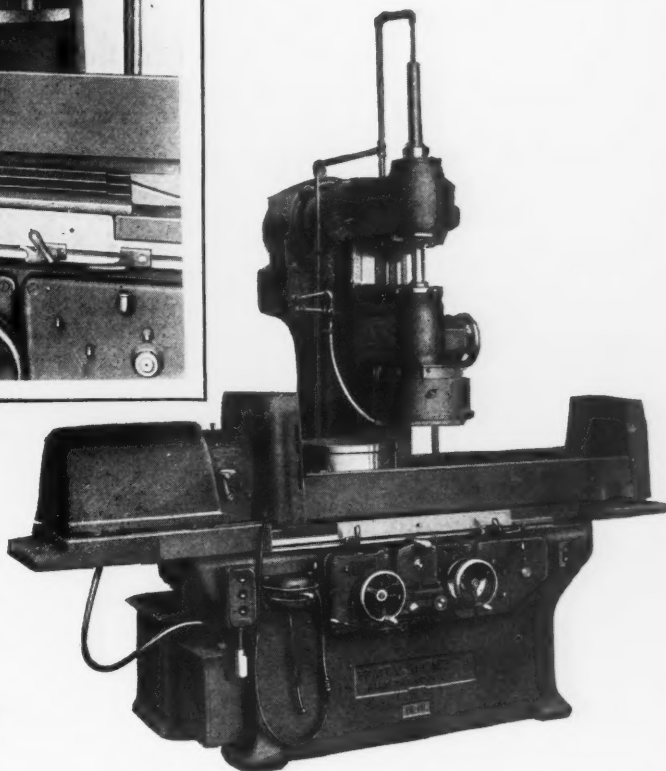


# Something new ... *and better*

**T**HIS new device is a plain or magnetic Rotary Chuck bolted on the table of the regular machine and driven by a separate motor through a two speed gear box.

With this chuck, the finest kind of rotary grinding is possible on rings, valve gates, disc work and countless other pieces. Greater accuracy can be obtained and as this method is much faster than milling for rough finishing, castings, etc., the earning power of the Vertical Surface Grinder with this Rotary Chuck makes it produce real savings as well as better work.

Water and oil cannot reach the coils of the magnetic chuck and in keeping with this powerful machine, the chuck is designed and built to have sufficient holding power for the jobs it will be called upon to do.



*Rotary Chuck, with separate motor drive.  
P & W 14" Vertical Surface Grinder*

For concave or convex surfacing, the chuck may be tilted by a set screw adjustment.

A 2 H.P. motor operated by a convenient push button on the side of the housing furnishes the power for the chuck. An automatic electrical brake stops the chuck when the power is cut off.

## Write for a circular

We will gladly send you a circular describing this chuck in detail and also a fully illustrated circular on the P & W Vertical Surface Grinder itself. Write for them.

## PRATT & WHITNEY CO., *Hartford, Conn.*

Division NILES-BEMENT-POND COMPANY

*Sales Offices:* BIRMINGHAM . . . BOSTON . . . CHICAGO . . .  
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BURGH . . . ROCHESTER . . . SAN FRANCISCO . . . ST. LOUIS

Pratt & Whitney Co., Hartford, Conn.

Please send me the story of P & W Vertical Surface Grinder and new Rotary Chuck.

Name

Address

Town  State

Position

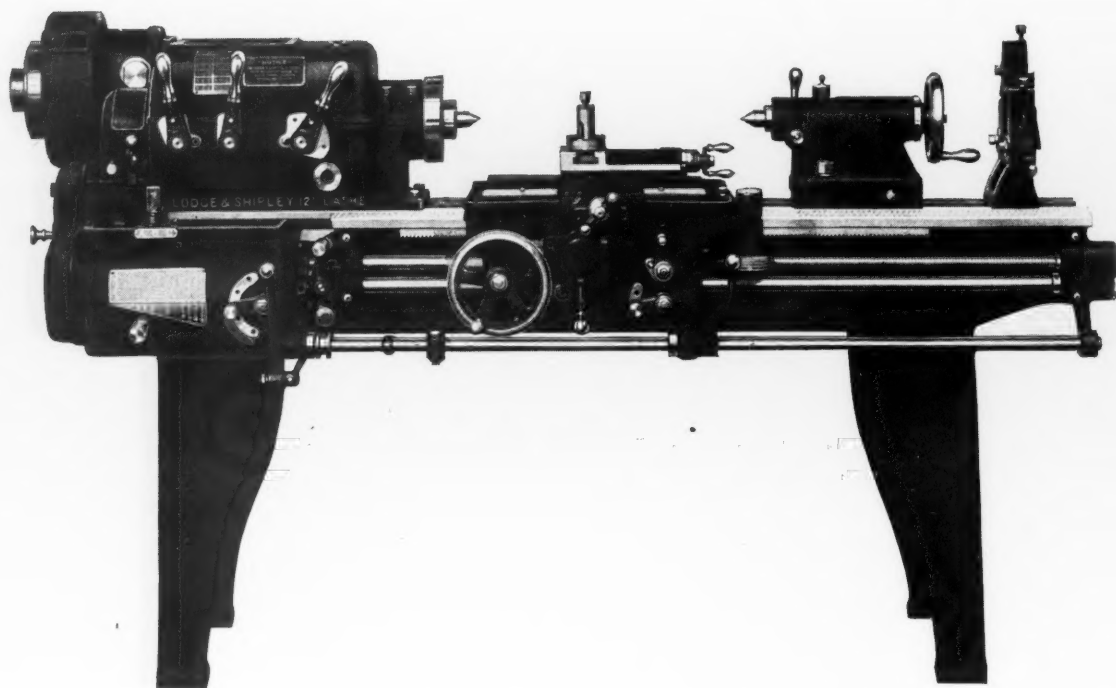
# An old friend remembers L

We heard from an old friend the other day in the pleasantest way imaginable. He sent us his order for another Lodge & Shipley lathe.

He owns a small machine shop and doesn't buy lathes very often. Five years ago we sent him a Lodge & Shipley and he remembered the good service he was getting from it.

He wrote that ever since he installed his first Lodge & Shipley he had had a friendly feeling toward us. When he was expanding his activities and needed another lathe he wanted to put a second Lodge & Shipley beside the first one.

We really enjoyed receiving that order. It is always a pleasure to hear from friends, friends made through the quality product we manufacture.



**12" Selective Head Engine Lathe**

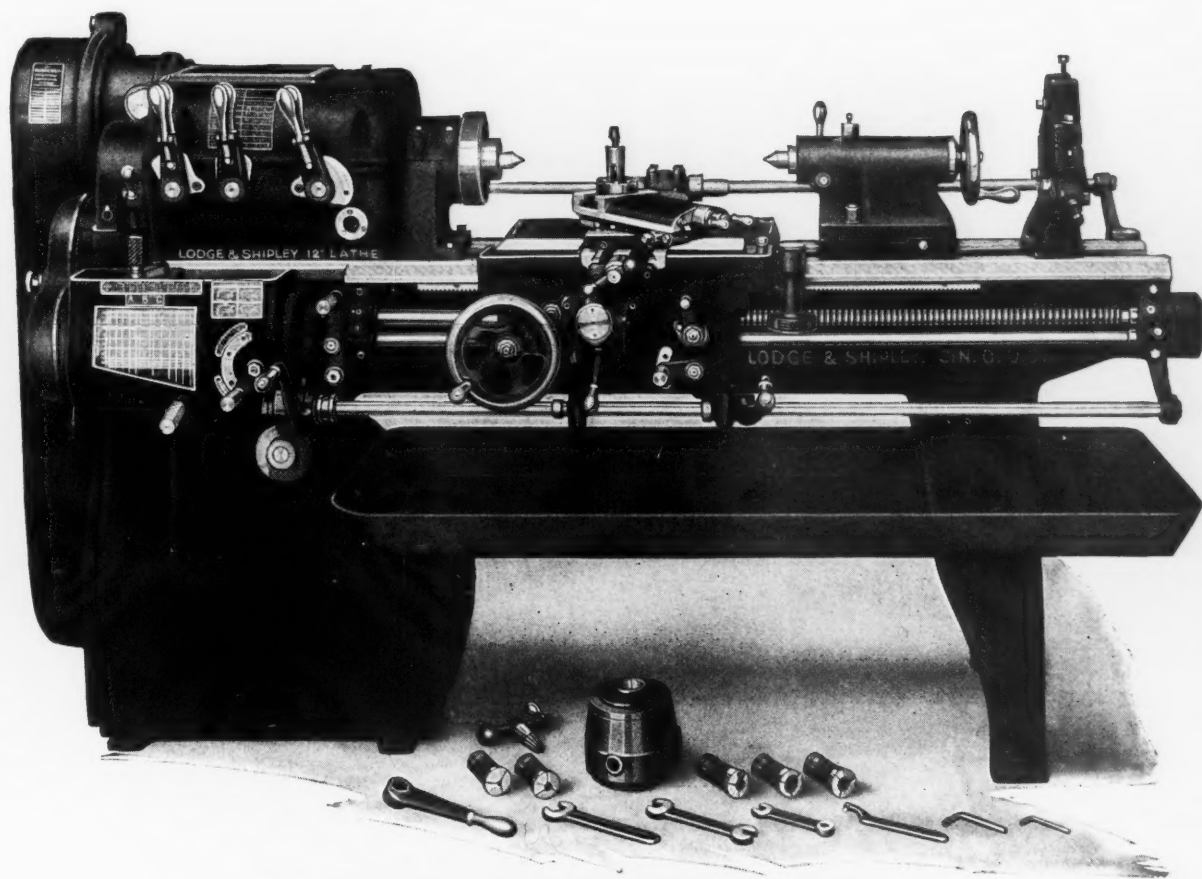
**The Lodge & Shipley**  
Cincinnati,

# **LODGE & SHIPLEY**

One can readily appreciate that our friend put in a lot of thought before buying another Lodge & Shipley lathe.

The lower priced machines being sold must have offered a tremendous temptation. Naturally in a small shop money wasn't any too plentiful and price must have received a great deal of consideration. In the end he decided on a Lodge & Shipley lathe.

After all, he knew what to expect from this lathe and he figured it was better to spend a little more and invest in a quality tool rather than gamble with it buying a cheaper tool. When you consider the matter thoroughly, buying a tool on quality is investing it, while buying it on price is something else again.



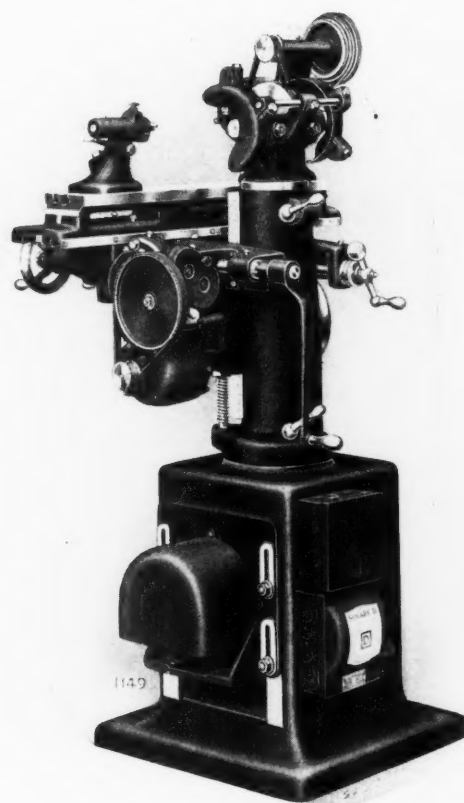
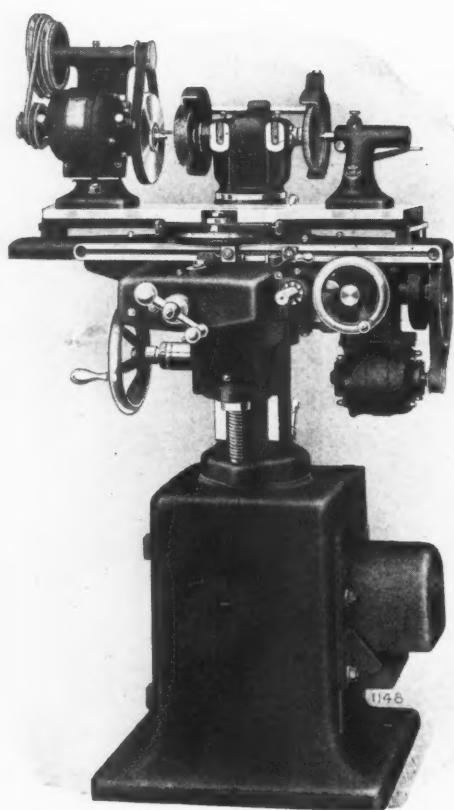
**12" Selective Head Tool Room Lathe**  
with Belted Motor Drive in Leg

**Machine Tool Company**  
Ohio, U. S. A.





A UNIVERSAL GRINDER FOR THE TOOL ROOM  
WITH AUTOMATIC POWER FEED  
AND INTEGRAL MOTOR DRIVE



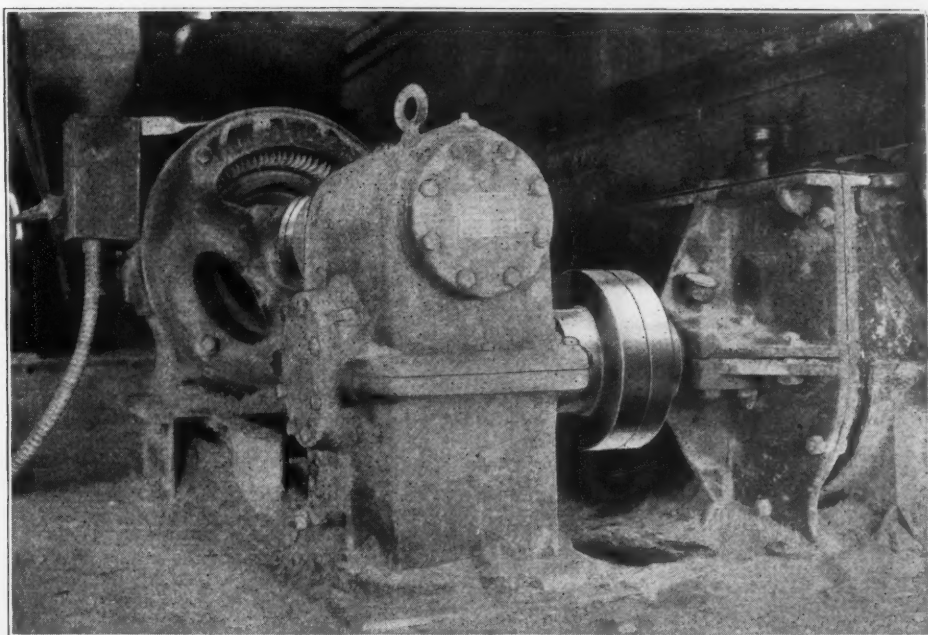
**LeBLOND UNIVERSAL TOOL ROOM GRINDER**

Built on the principle of a Universal Milling machine with a column, knee, saddle and swivel table, this machine is fully universal and will grind any angle, taper or face. It can be furnished with plain equipment for plain cutter and reamer grinding or with a complete set of attachments for all phases of tool room work, including cylindrical, internal and surface grinding. An automatic power feed to the table can also be furnished.

We also offer a new and improved motor drive arrangement with this machine. The motors are mounted integral with the machine and are direct belted. Consequently no countershaft or superstructure is required.

We have an interesting catalog and treatise on tool room grinding ready to be sent to interested parties.

**THE R. K. LeBLOND MACHINE TOOL CO.**  
**CINCINNATI, OHIO**



## WHAT IS THE BEST FLEXIBLE COUPLING?

A flexible coupling is a connector for drive and driven shafts. It must absorb shock, vibration, starting load and momentary overload, correct essential shaft misalignment, and allow free end float to motor armature under all conditions of load.

The coupling to best accomplish all this is the coupling with greatest flexibility.

Rubber, applied in all industry, and acknowledged to be the best flexing element, gives Ajax Flexible Couplings *greatest flexibility*. This advantage, together with the manner in which the rubber is used in Ajax Couplings (it is limited only to expanding and contracting work), gives Ajax a feature unobtainable in any other type of coupling. *Greatest flexibility*, then, plus utmost care and precision in manufacturing, are the reasons why Ajax Flexible Couplings are best for every purpose.

Use Ajax Couplings to absorb starting torque, overload, shocks and strains on your equipment—they last indefinitely. Buy from coupling specialists, and know the value of quick coupling service and correct design.

*Consult our engineers if you want a special coupling—send for our latest catalog which contains standard specifications, weights and prices.*

*Illustration shows two Ajax Flexible Couplings connecting motor and speed reducer to belt conveyor in a cement plant. Abrasive dust does not impair the work of Ajax—oilless bearings do not collect dust and do not require lubrication or cleaning.*

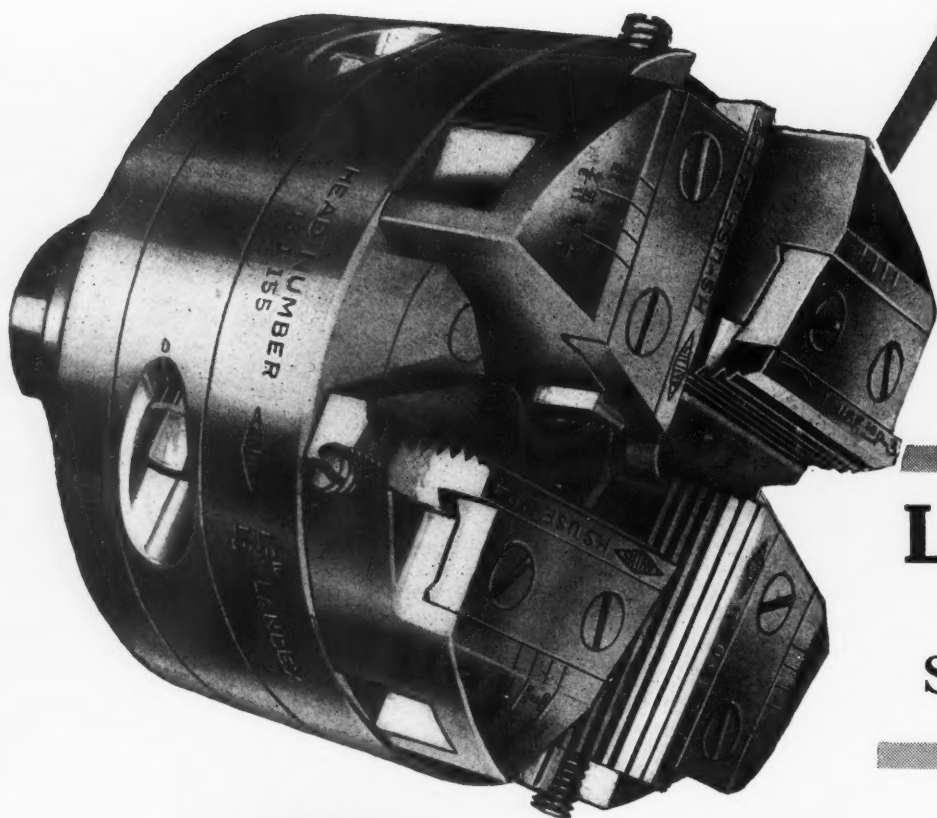
# AJAX FLEXIBLE COUPLINGS

*Inc.*  
INDUSTRIAL SHOCK ABSORBER

AJAX FLEXIBLE COUPLING COMPANY

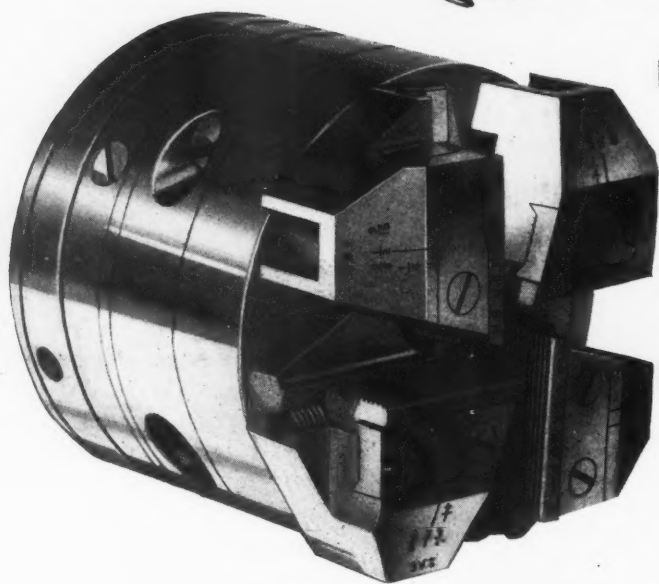
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## LANDEX

for Automatic  
Screw Machines

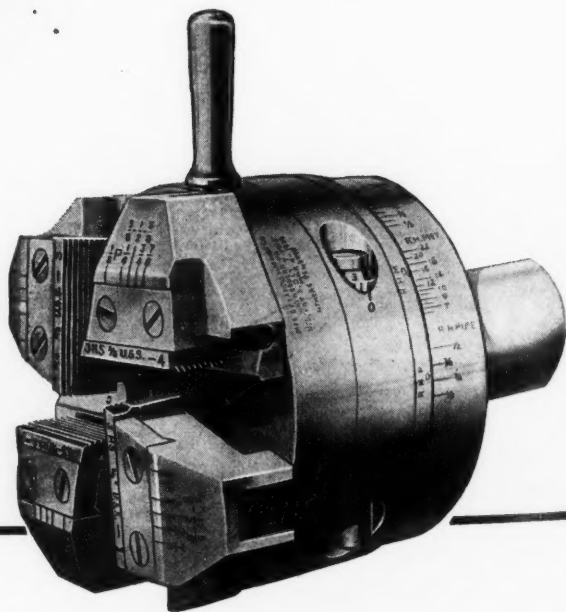


## LANCO

for Automatic  
and Hand Threaders

## LAND-MATIC

for Hand Screw Machines  
and Turret Lathes





# OW

## ~ a Landis Die Head

**For Automatic Screw Machines  
Automatic and Hand Threaders  
Turret Lathes and Hand Screw Machines**

In other words — a complete line of threading tools, developed by specialists in threading production, to meet the particular needs of each type of modern threading equipment. Landis Die Heads—Landex, Lanco, Land-Matic—are service tools. Simplified design, convenient operation, and *Landis Chasers* secure durability as well as production efficiency and service economy.

Send for details of the complete line of Landis Die Heads.

**LANDIS MACHINE COMPANY, Inc., Waynesboro, Pa.**

**Detroit Office: 5928 Second Blvd.**

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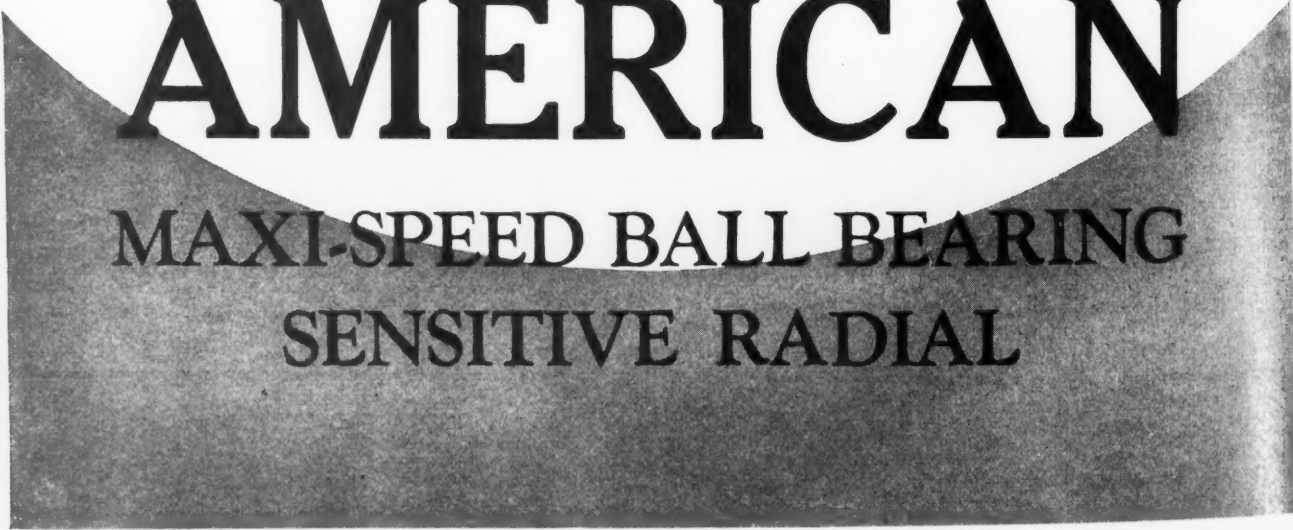
# Meets the Demand of M

## Speed *with* Accuracy

The "American" Maxi-Speed Sensitive Radial is a powerful, dependable machine that more than meets present-day production needs. It combines the convenience and range of the radial drill, with the speed and efficiency of the sensitive drill. This machine drills and taps holes up to and including one inch in diameter faster, better and more economically than they have ever been drilled and tapped before.

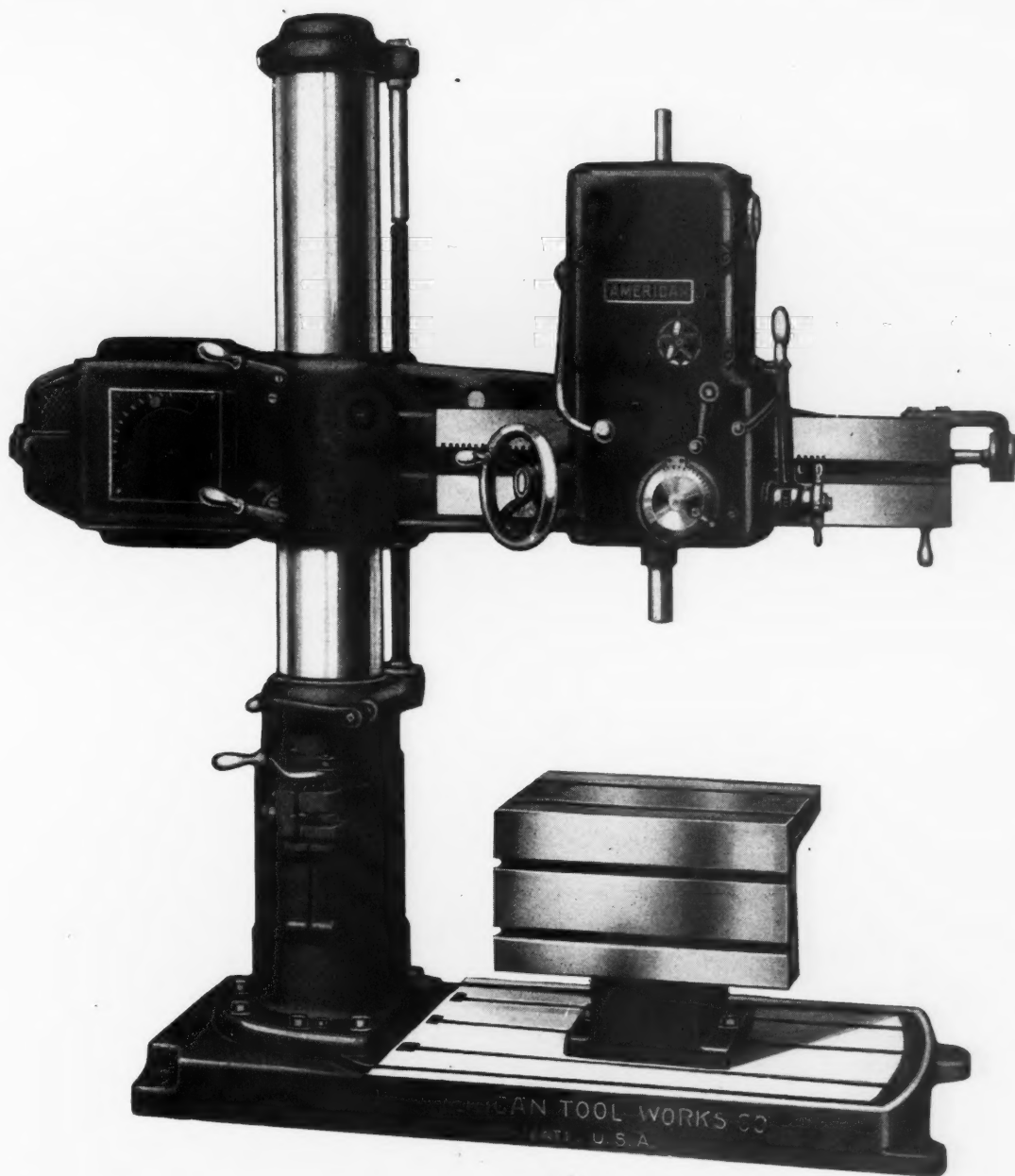
With speeds of from 500 to 2000 R.P.M. and the Power and Operating Convenience typical of "American" products, the Maxi-Speed, Sensitive Radial is extremely efficient on all work within its range.

**LATHES      RADIALS      SHAPERS**



**AMERICAN**  
**MAXI-SPEED BALL BEARING**  
**SENSITIVE RADIAL**

# of Modern Production—



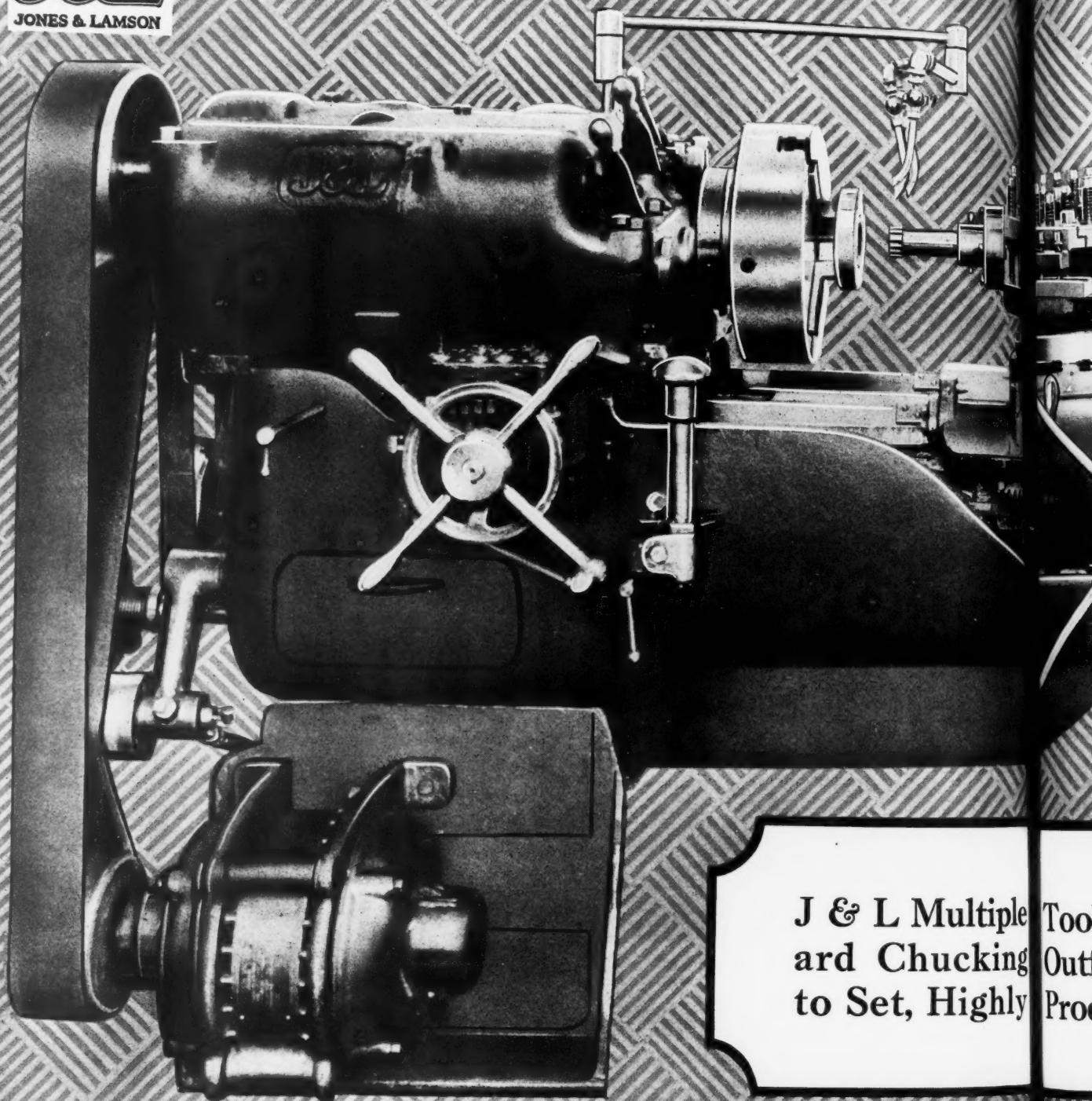
**The American Tool Works Co.**  
Cincinnati, U. S. A.

**"AMERICAN"**





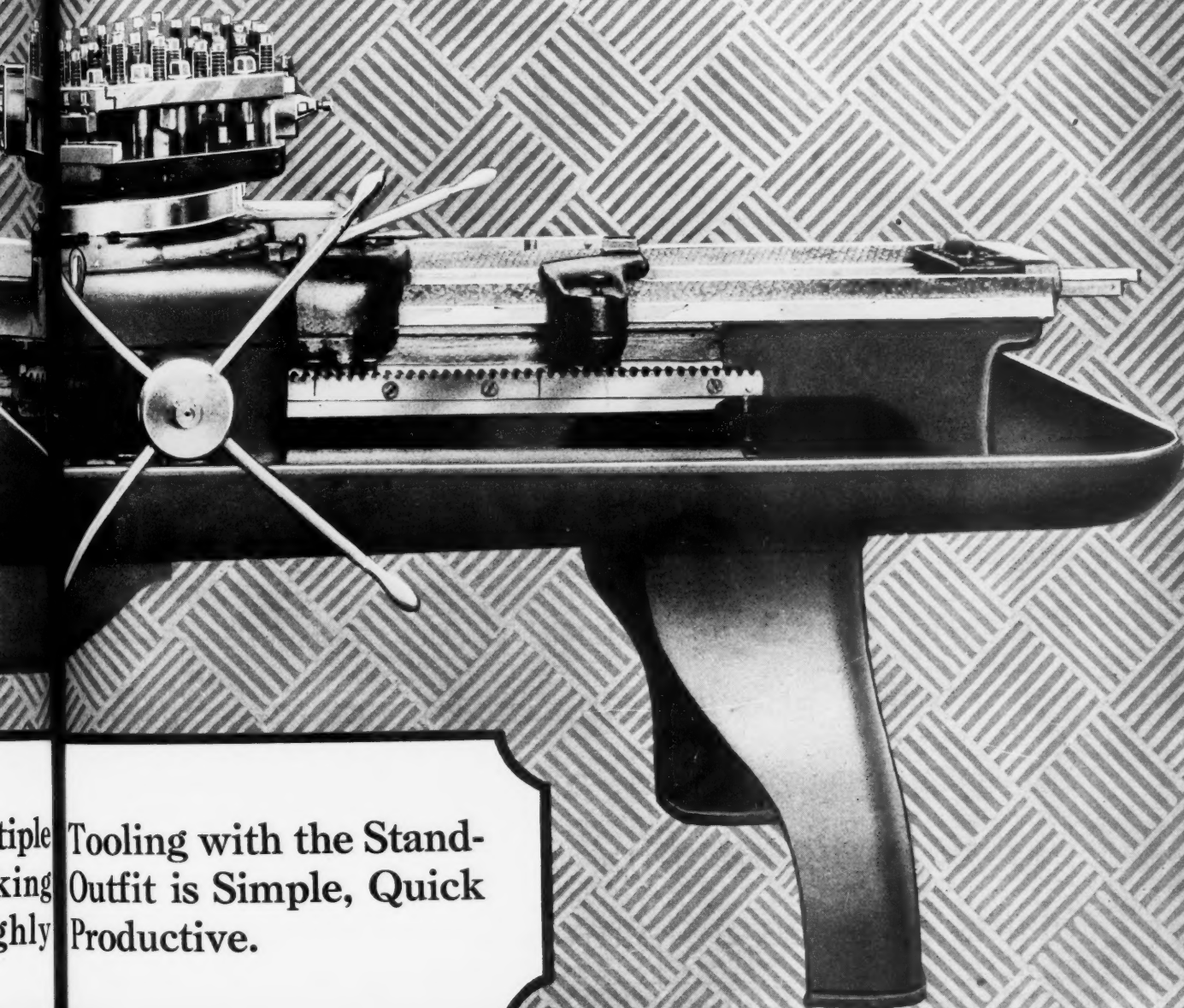
**J&L**  
JONES & LAMSON



J & L Multiple Tool  
and Chucking Out  
to Set, Highly Pro

**JONES & LAMSON MACHINE CO.**

**J&L**  
JONES & LAMSON



Multiple Tooling with the Stand-  
Outfit is Simple, Quick  
Productive.

**JONES & LAMSON COMPANY, SPRINGFIELD VT.**



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# *Automatic Internal Grinders*

are a thing of the future—of the near future, we expect.

Meanwhile the BRYANT Semi-Automatic SINGLE SLIDE Grinders are used throughout the world as standard equipment for internal grinding among the leading motor, aeronautical, motor accessory, ball bearing, machine tool, and other plants engaged in manufacturing iron and steel products.

**BRYANT CHUCKING  
350 CLINTON STREET**



**GRINDER COMPANY  
SPRINGFIELD, VERMONT**

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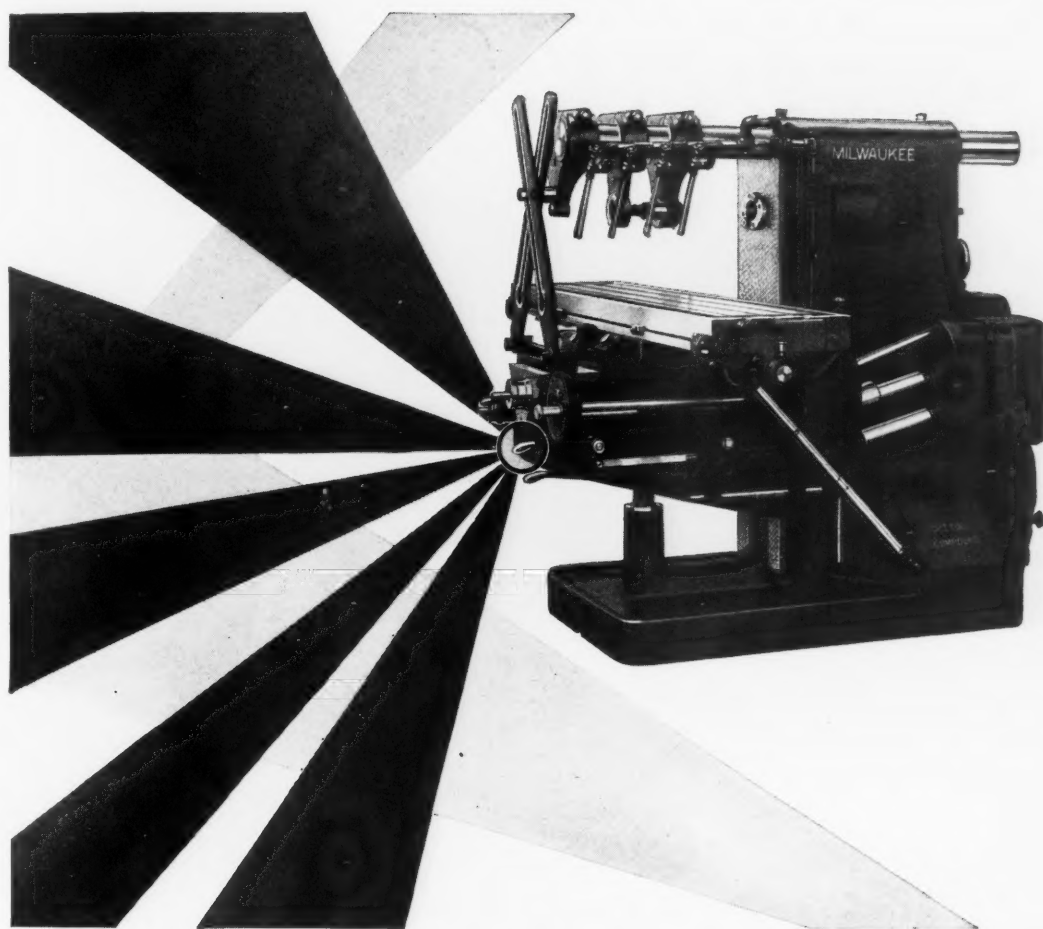
**U. S. A.**

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A single lever, one downward movement,  
and the faster travel instantly responds —

that's **Power Rapid Traverse!**



**N**OR is this feature just for the milling machine table. The same lever may be used for rapid traversing the knee UP or DOWN, at the rate of 50" per minute; or the saddle IN or OUT at 70" per minute.

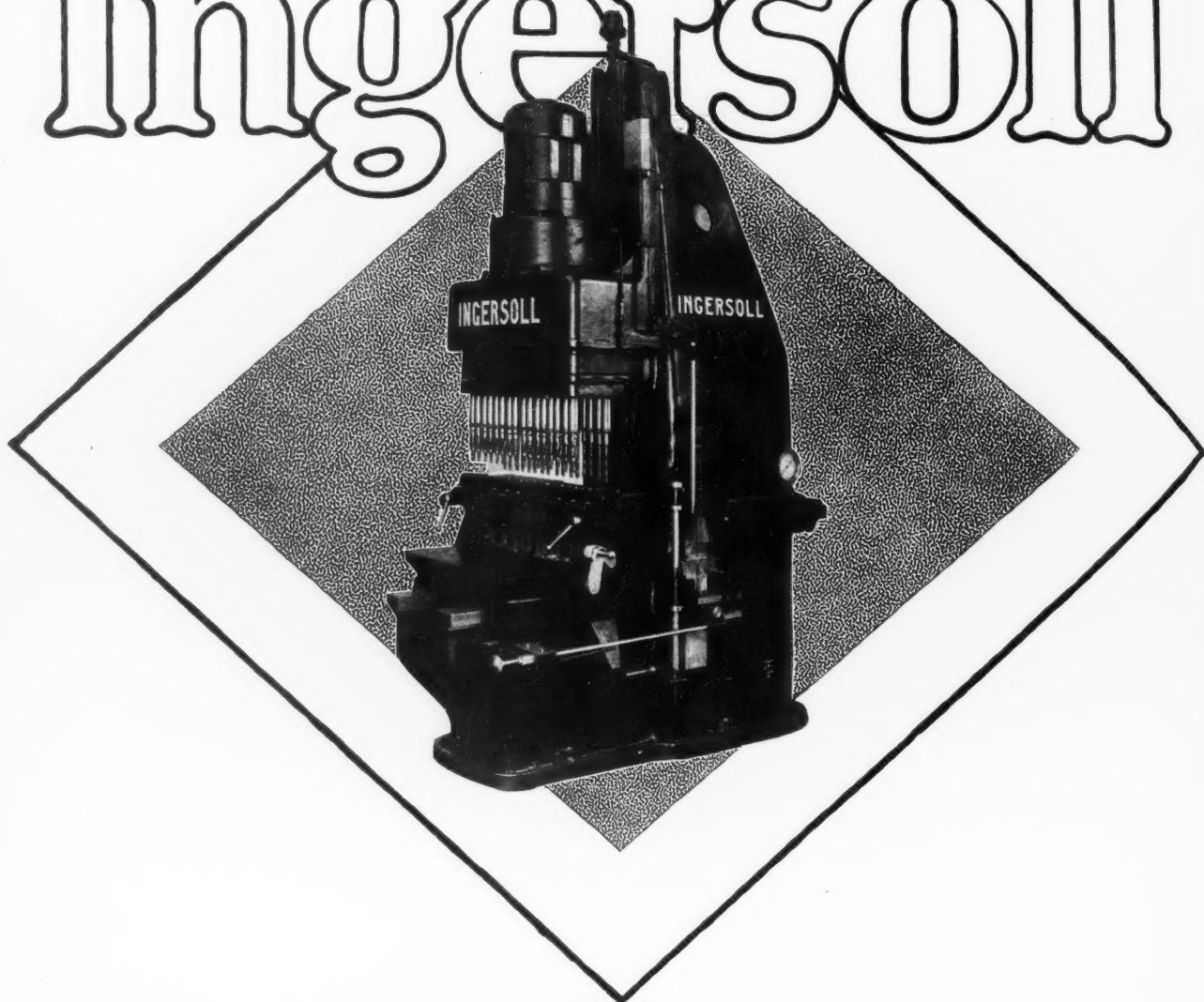
There are two rates of Power Rapid Traverse for the table, 150" per minute for fast production work, and a more moderate rate of 70" per minute for toolroom operations when using the Spiral Dividing Head. This is an exclusive feature only to be found on Milwaukee Milling Machines.

Run a Milwaukee yourself. You'll appreciate its simple convenience more in five minutes than we can tell you in a dozen catalogues.

**MILWAUKEE MILLING MACHINES**  
**KEARNEY & TRECKER**

MAIN OFFICE AND WORKS, MILWAUKEE, WISCONSIN

# Ingersoll



## Special Machines

**E**ACH Ingersoll machine is specially built for the job in hand, whether it is to be used on general work or for some special operation. The latter tools cover a wide range of milling, boring, and drilling machines, built to perform their particular operations better, faster, or at lower cost than they can be done in any other way.

The machine illustrated here is one of these special tools. It drills and bores the sixteen valve guide holes in an eight cylinder block. The cycle for the two opera-

tions is semi-automatic, and twenty blocks are turned out every hour.

It may be that your requirements are along some entirely different line, but it is probable that at some time we have had a similar problem put up to us. At any rate, if you have some machining operation with which you are not satisfied, we will be glad to go over your drawings with you. Our recommendations will place you under no obligation, and may solve your difficulties.

### BULLETINS:

No. 44—"Ingersoll Milling Cutters,"

No. 46—"Ingersoll Equipment for Railroad Shops,"

No. 47—"Ingersoll Milling Machines,"

No. 48—"The Ingersoll Cutter Grinder."

## The Ingersoll Milling Machine Company

*Milling Machines and Their Equipment*

ROCKFORD, ILL.

# Science Evolves an Entirely New Metal GRAPHITIC STEEL

This is the first public announcement to the machinery field of the results of twelve years of research and development in the perfection of an entirely new metal. However new to Industry in general, Gunite is not an untried innovation. For several years before this announcement, it has served in many practical applications—it has solved many problems for a score of manufacturers to whom it was introduced individually . . . introduced thus so that this announcement could tell of a new metal not only correct in theory, but one which had passed the acid test of hard, practical usage.

Gunite is an entirely new metal. It is NOT an alloy. It is a new *steel*—a *graphitic* steel. Its ferrous matrix is essentially the same as found in any high grade steel—stratified "Pearlite." It differs from ordinary high grade steel, however, in that short, fat graphite *flakes* are evenly distributed throughout its ferrous matrix. It is these graphite *flakes* which explain the unusual long wearing quality of Gunite. It is its molecular structure . . . the even distribution of graphite . . . the absence of hard "eutectic" spots . . . the absence of internal strains . . . that explains the many advantages Gunite offers which have never been available before in any other one metal.

Machinery builders will find Gunite tremendously desirable. Not only because it offers the solution to many problems—but because its price makes it immediately advantageous to replace semi-steel or cast iron without throwing costs out of line. A few of the parts in which it has had practical application are shown on this page. Gunite engineers are fully experienced and exact in their knowledge. Let them assist you in your problems.

Gunite is particularly desirable for parts of precision machines, and for cams, large and small moderate duty gears, worms, machine beds or ways, planer tables or surface plates, gear housings, spindle sleeves, racks, bushings, heavy duty bearings, clutch parts, brake parts, jigs, fixtures, gauges.

## THE GUNITE CORPORATION

Rockford, Illinois



Over twelve years unending scientific research were devoted to the discovery of Gunite



Gunite solved the problem of wearability in this Barber-Colman Automatic Spooler combination gear and cam.

How G  
for l  
h





# Comparison Proves the Many Advantages of GUNITE

The illustration at left shows the unetched surface of Gunitite magnified 100 diameters. The presence of the uniform short, fat flakes of graphite evenly distributed through the ferrous matrix contributes materially to the wearability of Gunitite under friction.



Gunitite has a combination of physical properties which makes it most valuable for many uses. It is extremely *strong—rigid*. It resists deformation of all types. It is not ductile like malleable or steel . . . it will keep its shape under stresses that will snap gray iron or semi-steel . . . under stresses that will permanently deform malleable or cast steel. In tension Gunitite averages 35,000 pounds per square inch and thus offers rigidity as one important advantage.

Gunitite is *wear resisting*. The average hardness is about 180 Brinell. This hardness is due to *toughness*, and does not entail brittleness. Due to the presence of evenly distributed microscopic graphite *particles* (not veins) in Gunitite it does not cut in service like other *hard* materials. It shows most unusual resistance to wear from hard dry particles, to wear on dry sliding surfaces, and to wear on lubricated surfaces.

Gunitite *machines* easily because of the graphite content and freedom from hard spots. Its graphite particles are only a fraction of the size of those formed in gray iron which makes Gunitite machine with a very smooth clean surface.

Gunitite is not "*sticky*." It does not grab or pull chunks out of the other metals under friction. Sliding or braking surfaces of Gunitite show no evidence of scoring. Gunitite die parts do not roughen sheet metals.

Gunitite can be *hardened*. It can be hardened to 477 Brinell (better than "file hard") by simply heating to 1600° F. and quenching in water or oil. A variation of 50° does not greatly affect its properties. Hardened Gunitite develops the amazing compression strength of 225,000 pounds per square inch. Shrinkage is less than 1 part in 1000. Distortion is practically nil.

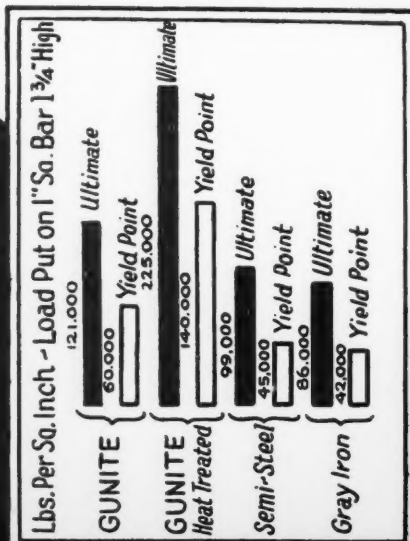
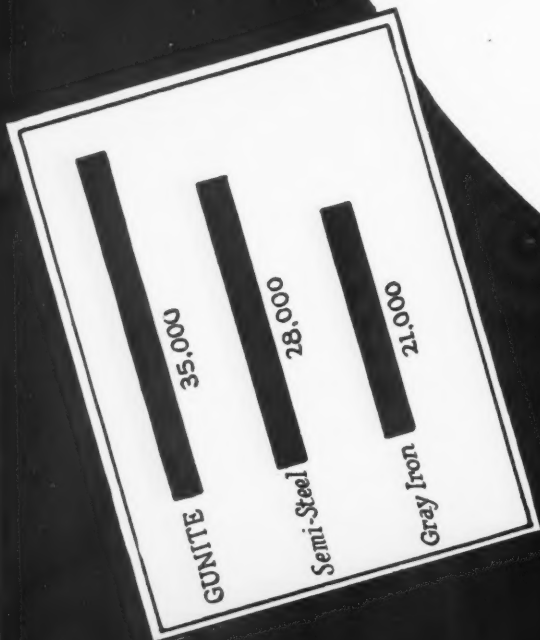
Gunitite is *uniform*. It has *no* hard spots, and does not need to be annealed before machining. Gunitite has unlimited uses.

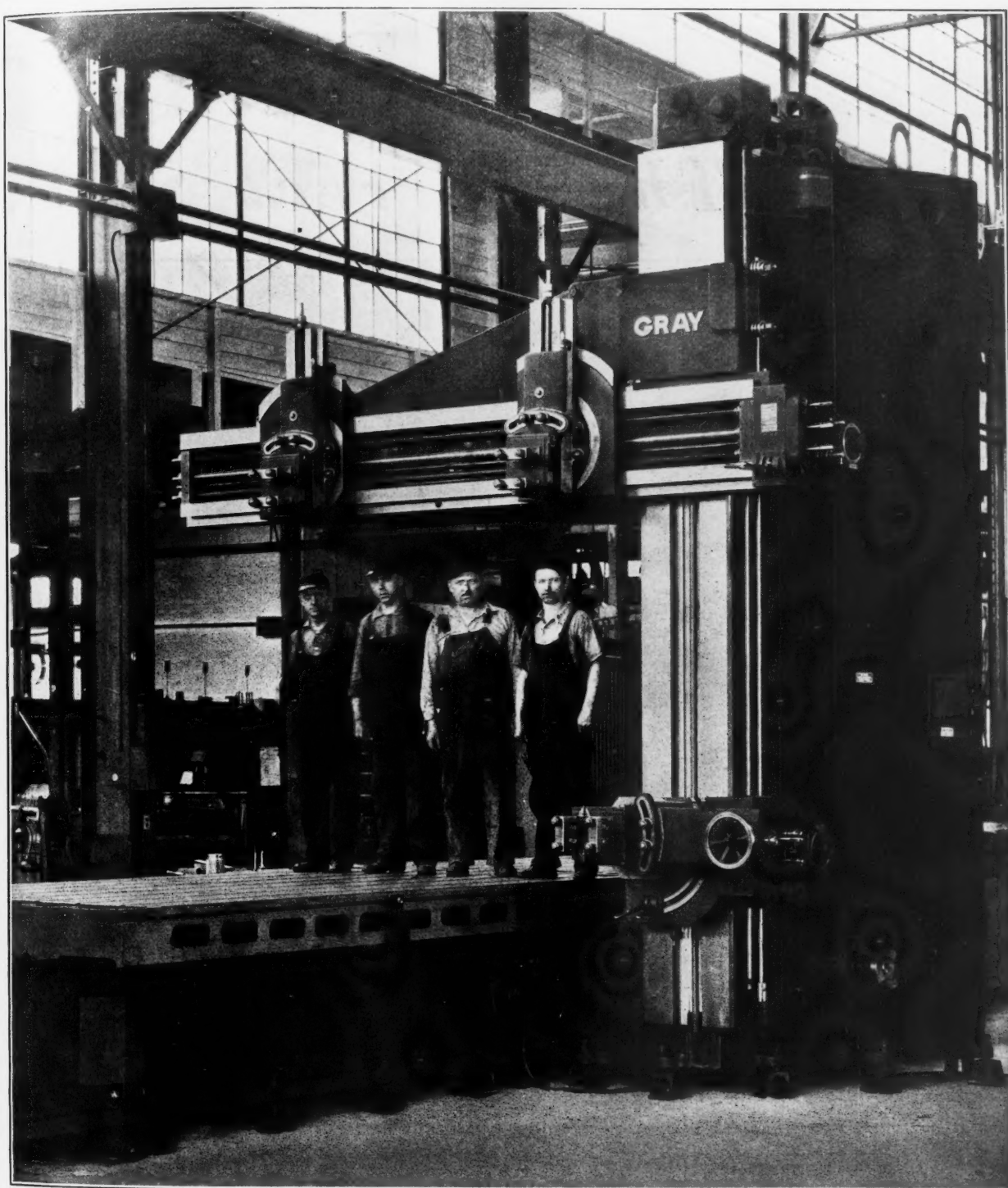
Write for any further information you require. Gunitite engineers are ready to work with you to adapt this new material to your requirements.

THE GUNITITE CORPORATION, Rockford, Illinois



Write for this Book  
A complete, interesting  
story of the development of  
this new steel.





**8' x 8' x 24' Gray Openside Maximum Service Planer  
In the plant of The National Tube Co., Lorain, Ohio.**

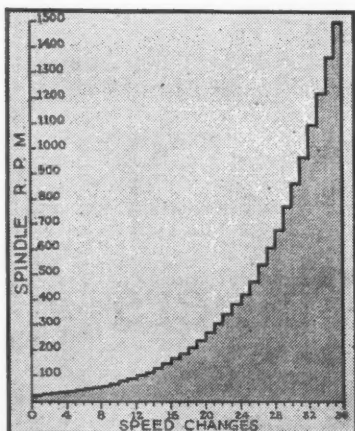
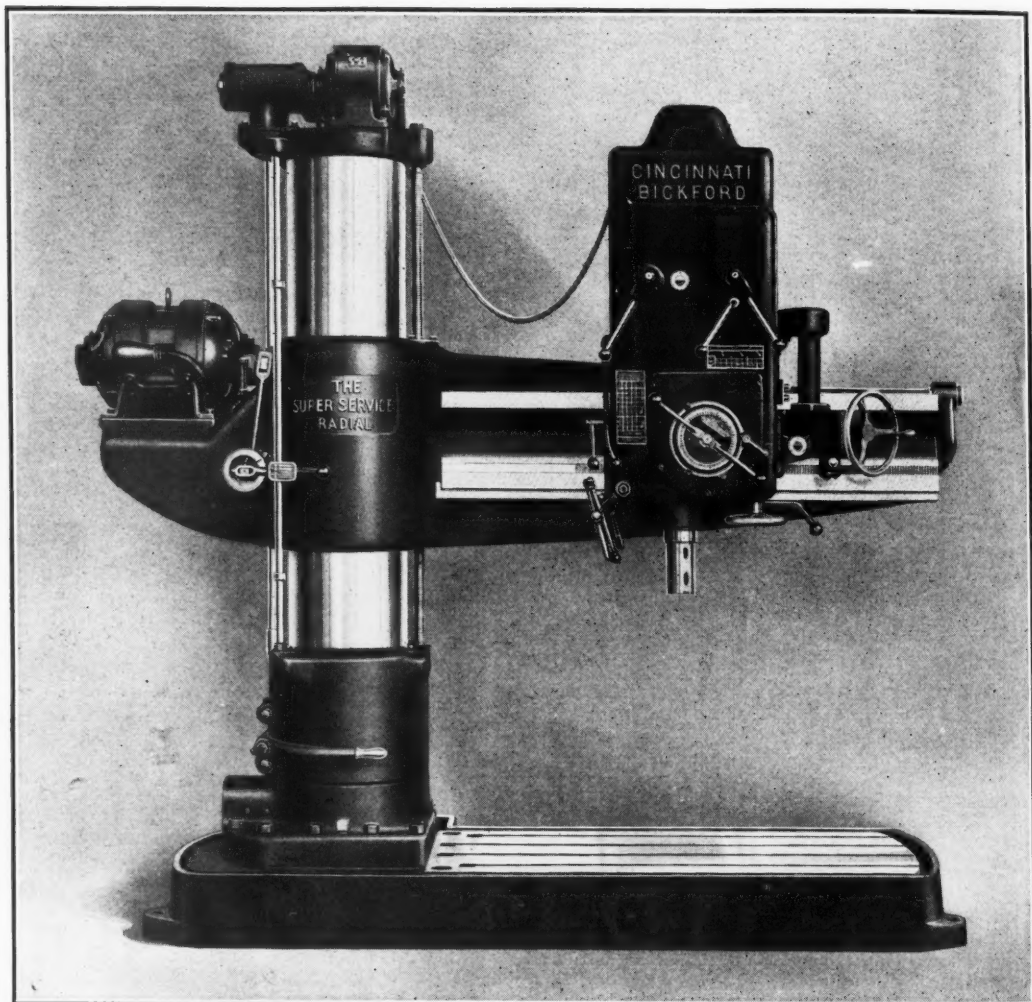
## **Gray Maximum Service Planers**

**Openside and Double-Housing.  
Many sizes, but only one quality.**

**The G. A. GRAY CO., Cincinnati, Ohio.**

# DRILL

## *The Correct Speed*



Note the Uniform Progression  
No Overlapping in Speeds

36 Speeds are instantly available through centralized control at the head. The right speed for small drills or for large boring and facing tools is quickly obtained. There is no duplication nor overlapping of speeds. Note how uniformly they progress in definite mathematical order from the lowest to the highest as shown on the speed curve diagram. This is accomplished with only 17 gears.

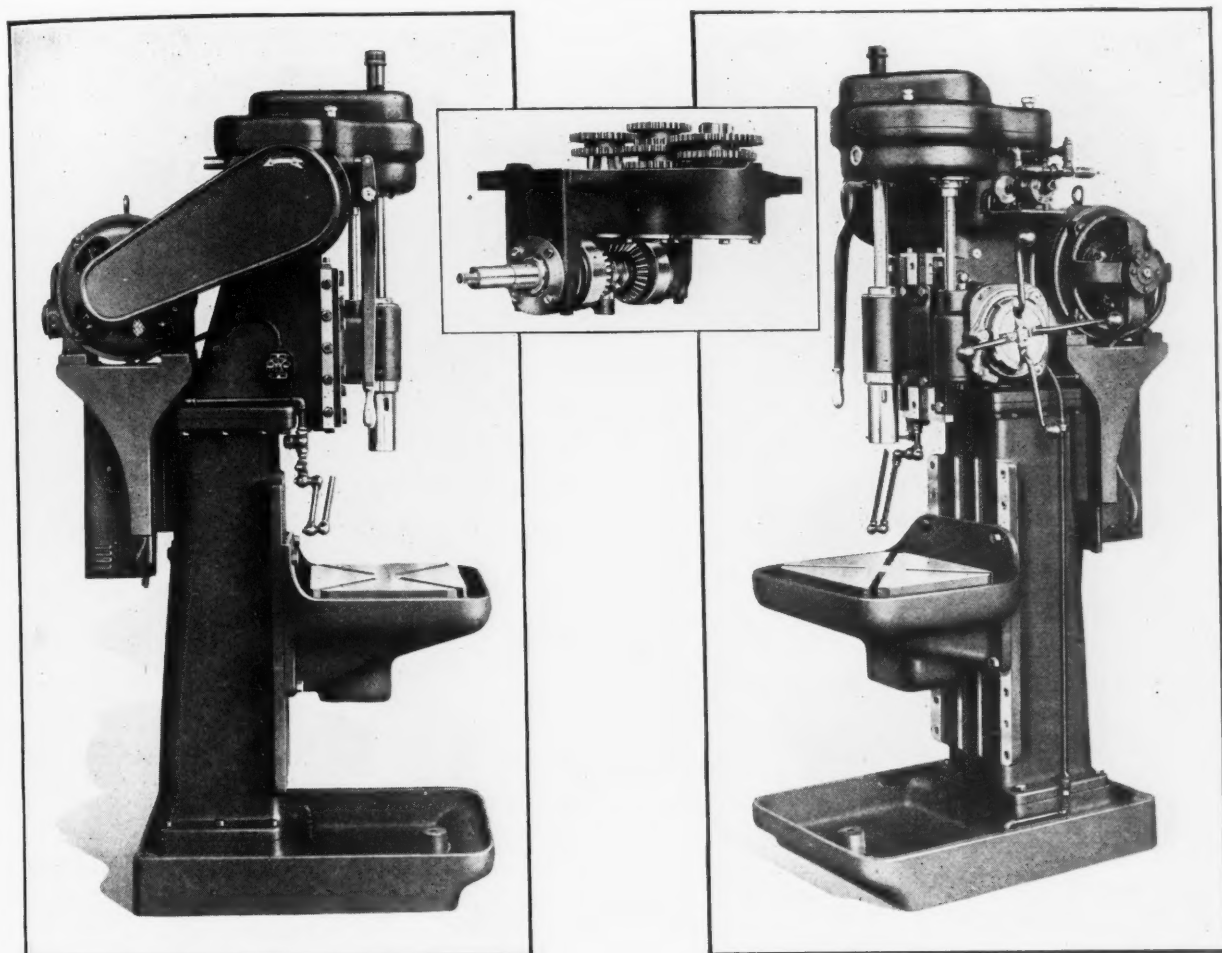
*The* **SUPER**  
**SERVICE** *Radial*

THE CINCINNATI BICKFORD TOOL



# FASTER

*is Quickly Obtained*



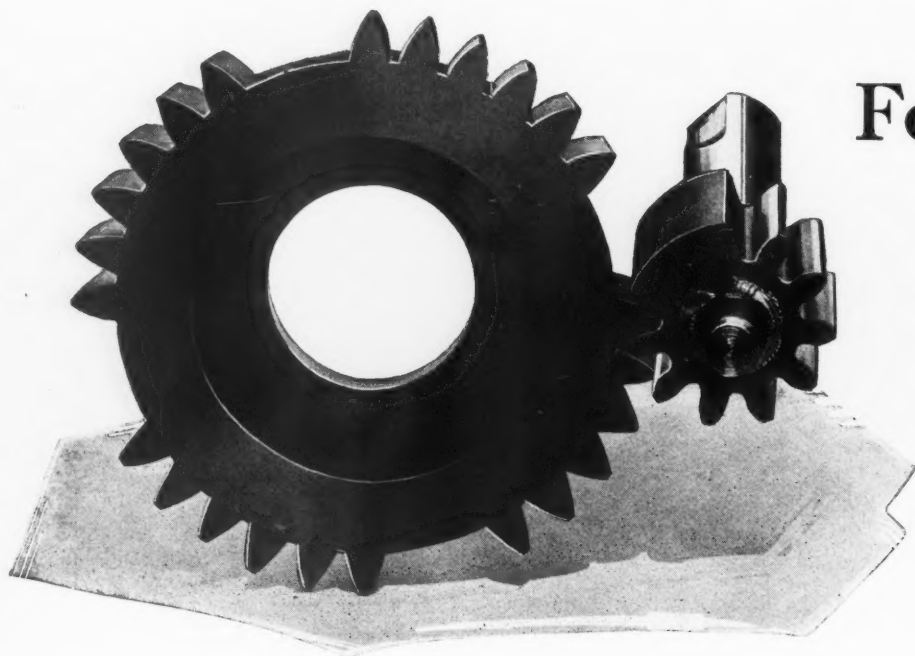
Although the SUPER-SERVICE Production Drill ordinarily runs for months at a time at one speed and one feed, there are 16 speeds and 16 feeds available by merely transposing a few gears in the head. There is no delay because these gears are a part of the machine. Sixteen closely graded speeds from 263 to 1233 R.P.M.

are obtained with only three gear contacts between driving shaft and spindle. Simplicity in design with flexibility of speeds and feeds distinguish this machine.

Gears and shafts are of heat-treated alloy steel and revolve on ball bearings. A splash oiling system insures complete lubrication.

*The* **SUPER-SERVICE** *Production Drill*

COMPANY, OAKLEY, CINCINNATI, OHIO.



## For the Usual as well as the Unusual Job

The High-speed Gear Shaper can be adapted with profitable results, not only to the usual but also to the unusual job.

A good example of an unusual job is the pinion for a door closer illustrated.

Notice that this pinion has eight complete teeth and a projection equal to three teeth.

The flat on the shank must bear a definite relation to this projection and be held so within close limits.

Formerly the teeth on this pinion were produced by milling — production was low, and the work was not sufficiently accurate. The High-speed Gear Shaper not only increased production several times, but produced work of the required accuracy. One revolution of the cutter completes four pinions, and each pinion is finished to size in one cut.

# THE FELLOWS GEAR SHAPER

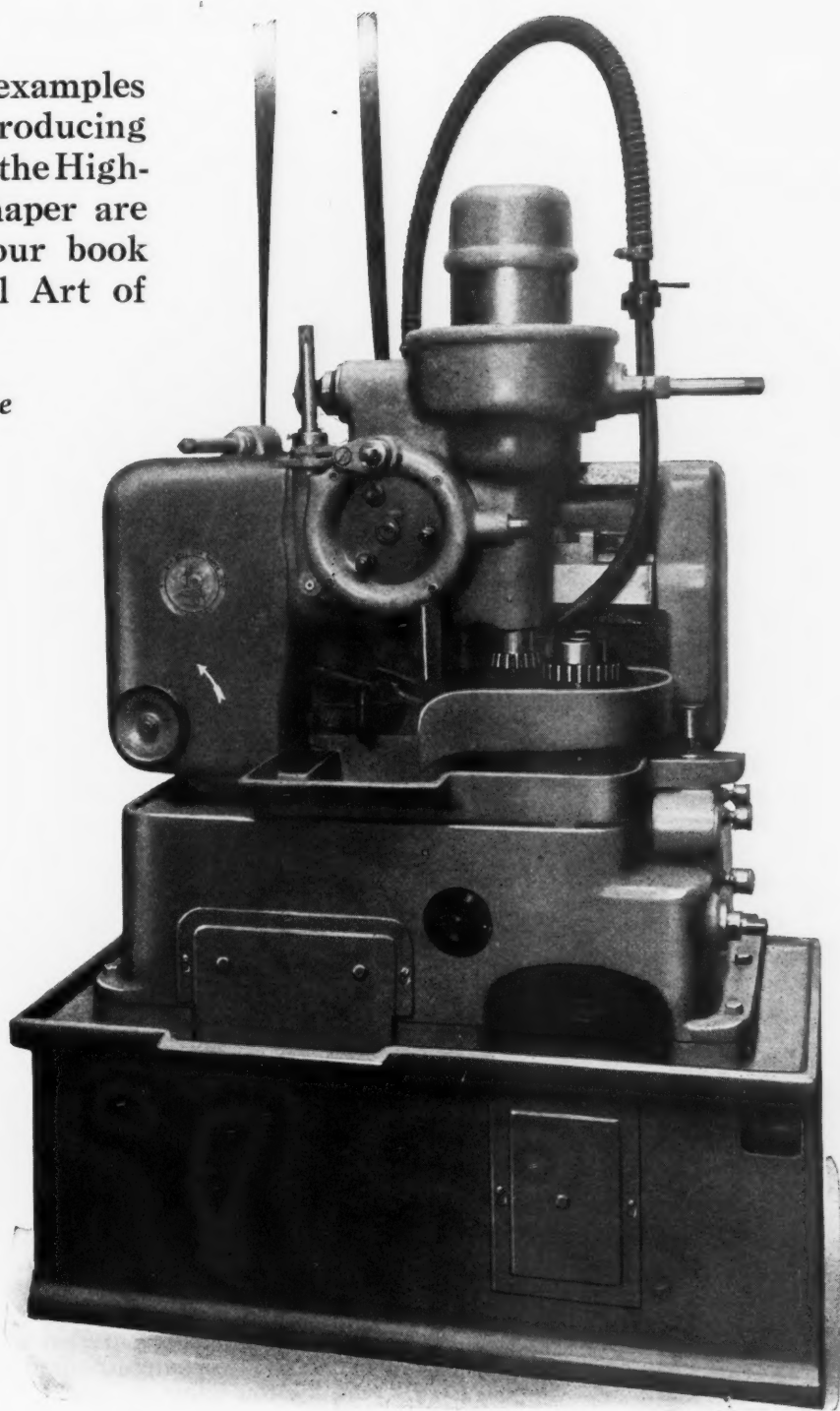
Head Office and Works:

Branch Office: 1149 Book

FOREIGN AGENTS—Alfred Herbert, Coventry, England—Great Britain; Alfred Herbert, Sydney—Australia; Societe Anonyme Alfred Herbert, Paris—France and Spain; Societa Anonima Italiana Alfred Herbert, Milan—Italy; Societe Anonyme Belge Alfred Herbert, Brussels—Belgium and Holland; Alfred Herbert, Ltd., Osaka and Tokyo, Japan; Bohm & Bormann, Berlin—Germany, Czecho-Slovakia and Austria; Aktiebolaget A. Bonthron, Stockholm, Sweden, Finland and Norway; American Machinery Import Co., Zurich—Switzerland.

Many other examples of the profit-producing possibilities of the High-speed Gear Shaper are presented in our book "The Practical Art of Generating."

*Would you like  
a copy?*



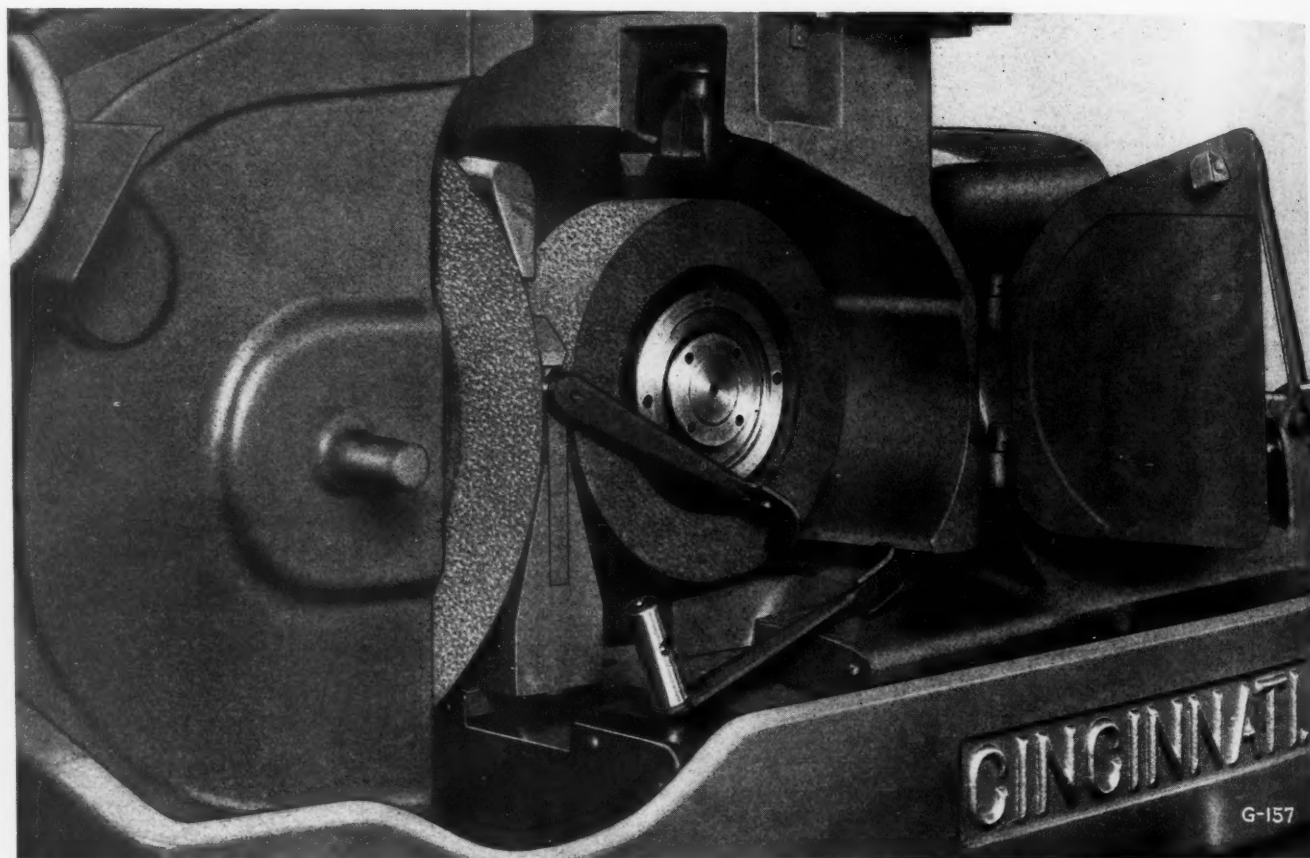
## COMPANY, Springfield, Vermont

78 River Street

Building, Detroit, Mich.

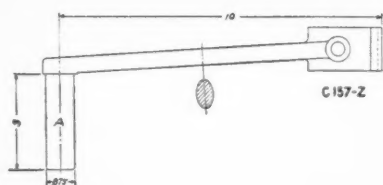
DOMESTIC REPRESENTATIVES—C. F. Bulotti Machinery Co., San Francisco, Northern California; Reeves & McBride, Los Angeles, Southern California; R. S. Armstrong & Bros. Co., Atlanta, Ga.; Montgomery & Crawford, Spartanburg, S. C., for South Carolina and Western North Carolina; Young & Vann Supply Co., Birmingham, Ala.; Oliver H. Van Horn & Co., Inc., New Orleans, La., for Louisiana, Mississippi, Western Florida and Eastern Texas; Huey & Philp Hardware Company, Dallas, Tex., for Western Texas.





Patented

## THE FIELD OF CENTERLESS GRINDING INCREASES



**Operation**—Grind dia. "A."

**Material**—Heat treated forging.

**Stock Removed**—.025".

**Finish**—Very good.

**Limits**—.0005.

**Production**—4 per minute.

**Machine**—No. 2 Cincinnati Centerless.

**Wheel**—20" dia. x 4" face  
60-N-Aloxite.

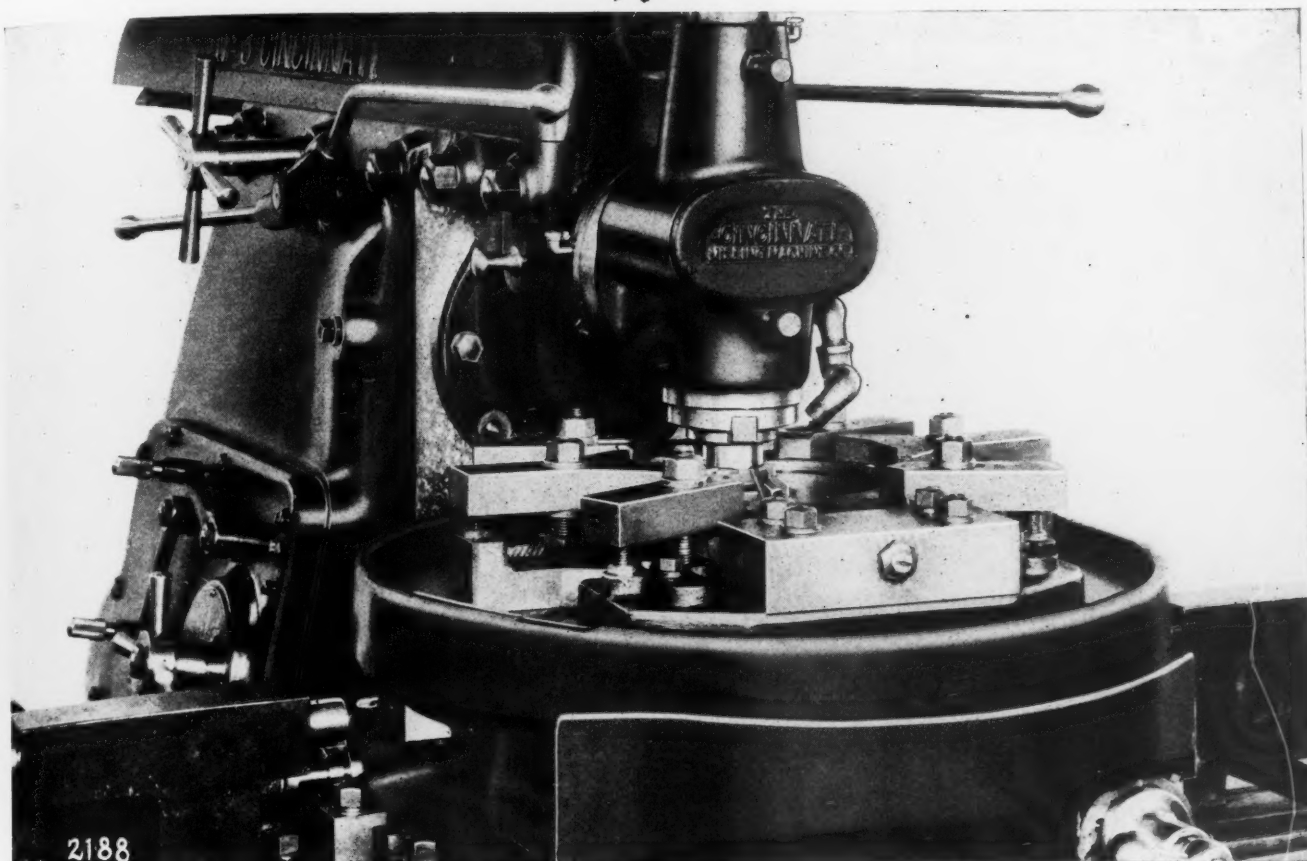
Work similar to that shown in the attached sketch can now be handled successfully on the Centerless Grinder, heretofore considered an impossible job. The infeed method is used in grinding the stud portion. The work is positioned from the shoulder by contact with an outer end of the work blade. Provision is made, however, for end stop at the rear, if this is desirable. An overhead support co-acts with the movement of the infeed lever, and has an angular equalizing contact with the work, holding the piece being ground in firm contact with the regulating wheel while the work is being advanced to the grinding wheel.

The release of pressure of the spring actuated overhead support is so timed that the work is held in contact with the feed wheel until withdrawn from the grinding wheel. The overhead arm is held in open position for quick insertion of the work until the forward movement of the slide automatically again causes the arm to descend and grip the work. The overhead yielding pressure permits the grinding of a variety of work in which the overhanging, unground portion exceeds in weight or bulk, the section being ground. Special wheel locking collars and additional clearances in the machine are provided, as shown, to permit the full sweep of the work. Here is an increased opportunity for the profitable application of the Centerless Grinder. Send us any parts that you may have so that we can tell you just what we can do for you on your work.

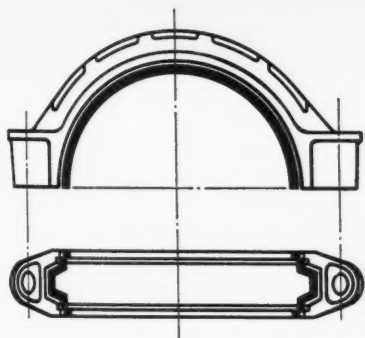
*"A New Service with New  
Methods of Grinding"*

**CINCINNATI GRINDERS INCORPORATED**  
Cincinnati, Ohio

# CINCINNATI GRINDERS



Patented



Z-2188

Part Name—6" Pipe Joint Housing.  
Operation—Form Mill Inside Diameter.  
Material—Malleable Iron.  
Stock Removed— $3/32$ ".  
Cutter—4" Diameter Form Mill on Special Stub Arbor.  
Speed—87 R.P.M.  
Feed— $12\frac{1}{2}$ " per minute.  
Time per Piece—1 Minute.  
Pieces per Hour—52.  
Machine—Cincinnati No. 3 Plain High Power Miller with Circular and Vertical Attachments.

## DOUBLE DUTY

The ingenious use of attachments allowed the user of this equipment to get double duty out of his machine by using it for two operations on pipe joint housings. In the illustration above, it is being used for form milling the inside diameter.

The Circular Milling Attachment is fitted with a special fixture holding two pieces which is arranged so that it can be reciprocated from one milling station to the other. In this case, the fixture was reciprocated by hand, but it can also be done by power.

Each piece is held by three slotted clamps acting directly over fixed stops. The block at the front of the fixture is a housing for spring-actuated arms which automatically locate the work by forcing it back against stops at the rear of the bolt bosses. Provision is made for handling sizes of work from 6" to 12" diameter.

Operation is practically continuous, as the operator unloads and loads one piece while milling the other. The Circular Milling Attachment rotates by power through one-half revolution and stops automatically. The operator reciprocates the fixture to bring the other piece into milling position and the cycle is repeated.

Good attachments give very satisfactory service and greatly increase the usefulness of a Miller. The Vertical Milling Attachment is bolted securely to the face of the column and clamped to the underside of the Rectangular Overarm—a mounting that assures great rigidity and absolute alignment.

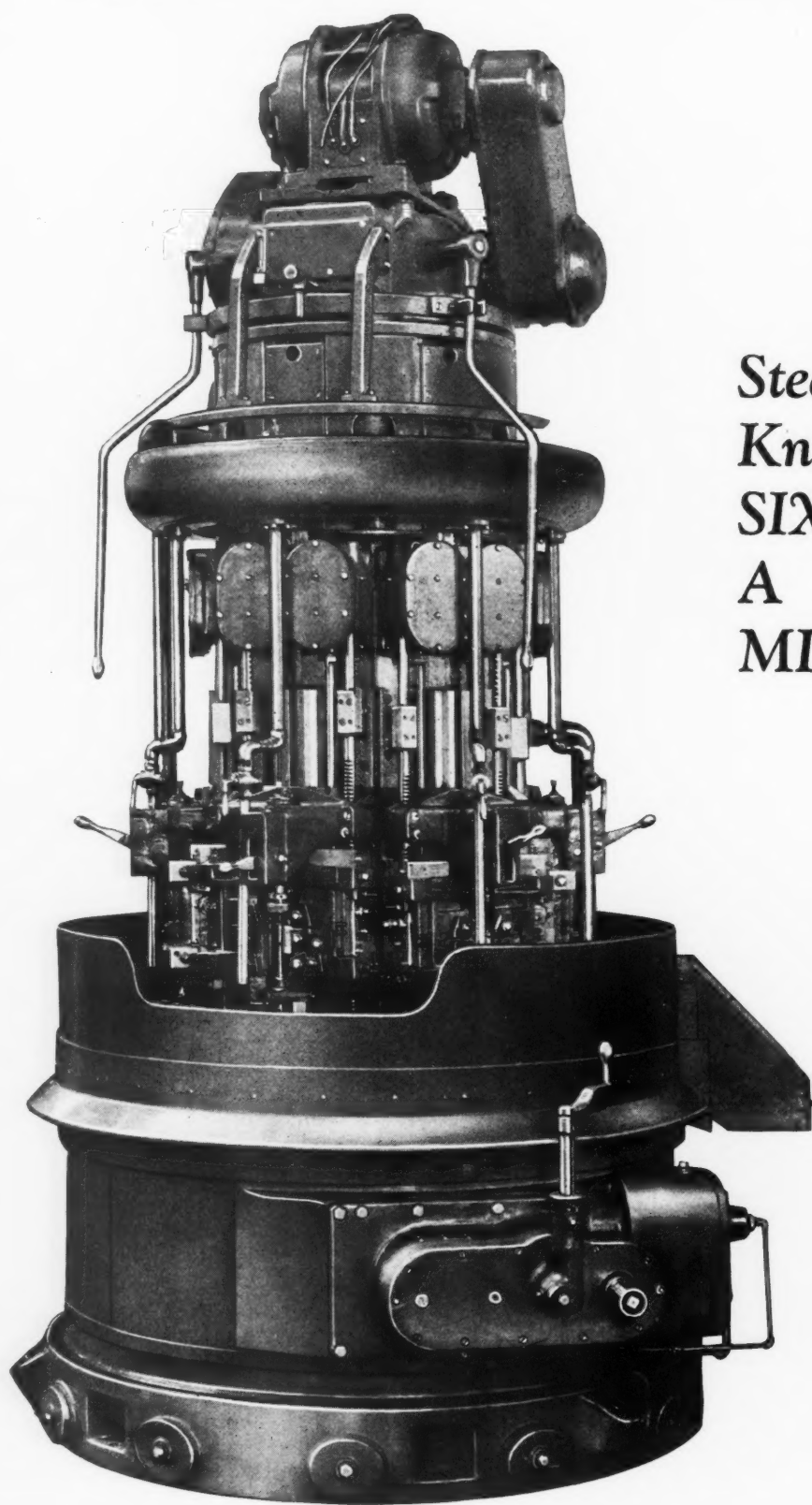
*The Right Machine for the Job*

THE CINCINNATI MILLING MACHINE COMPANY  
Cincinnati, Ohio

# CINCINNATI MILLERS

**BULLARD**

**CONTIN-U-MATIC**

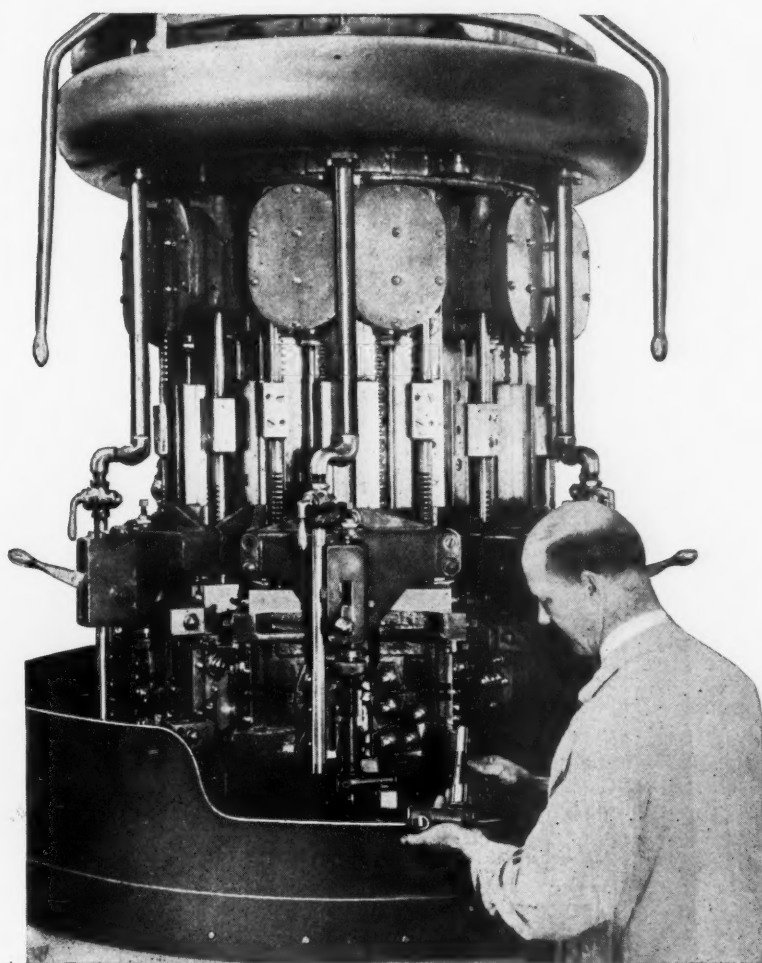


*Steering  
Knuckles—  
SIX  
A  
MINUTE*

**THE BULLARD MACHINE TOOL**



# IC CENTER LATHE



**T**HE Contin-U-Matic Center Lathe was developed for machining work held between centers.

It is an automatic multiple-spindle production machine operating on the principles of the Contin-U-Matic Chucking Machine.

The six spindles and six tool heads form individual units. In operation, one complete cycle of rotation suffices for chucking, machining and unloading of a single piece, but six units are produced during the cycle time.

The machine has a  $9\frac{1}{4}$  in. swing under the tool slides and  $5\frac{1}{4}$  in. diameter clearance between tool slides.

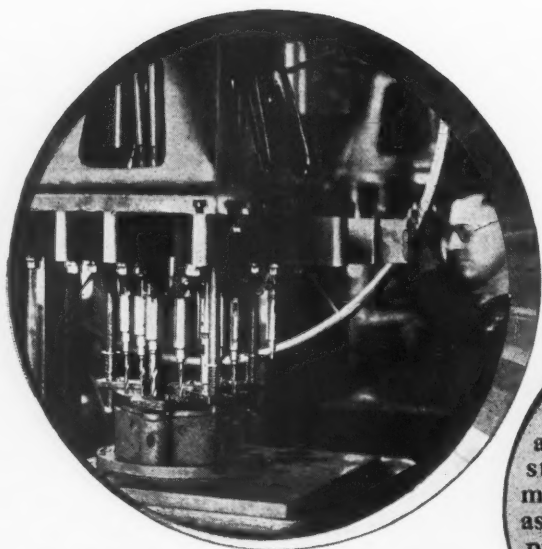
The maximum travel of plain vertical tool stroke is a little over 9 in. and the horizontal stroke is  $1\frac{1}{4}$  in.

This arrangement of tool slides in each head provides for a considerable variety of independent tool applications grouped in each unit and the two independent slides of each head will therefore accommodate an extensive variety of grouped operations performed simultaneously.

In operation the machine can be completely controlled from one position while main-drive clutch levers are provided at three different points about the cycle.

*Our Circular gives full details of this new unit, and will make interesting reading to every mechanically minded man*

**L COMPANY, Bridgeport, Conn.**



Eight 23/32-inch, two 5/8-inch and two 3/4-inch Cle-Forge Drills are chucked in a National multi-spindle drill press for this job. Spindle speed for all drills is 600 r. p. m. Cutting speed is 58.9 f. p. m. for 5/8-inch drills; 98.2 f. p. m. for 3/4-inch drills and 112.9 f. p. m. for 23/32-inch drills. Automatic feed is set at .0042" per rev.

12-drill set up on cast iron shell (see photograph at lower right) demonstrates nearly 3 times as many holes for Cle-Forge as against carbon steel drills previously used—55,000 against 19,950 holes—and 3/4 of each Cle-Forge Drill left over for other jobs!

**Cle-Forge High Speed Drills cut a sharp 48% hole through drill costs!**

Cle-Forge Drills had a life of 100 weeks; carbon steel drills lasted 36 weeks. During these periods, 36 carbon steel drills broke—but only 11 1/2 Cle-Forge. Although the original cost of Cle-Forge Drills was more than twice the cost of carbon steel drills, the ACTUAL cost of Cle-Forge was just *one-half* the cost of carbon steel drills—per 100 parts drilled! Proving, once again, that the COST of a twist drill is in its PERFORMANCE—not its price.

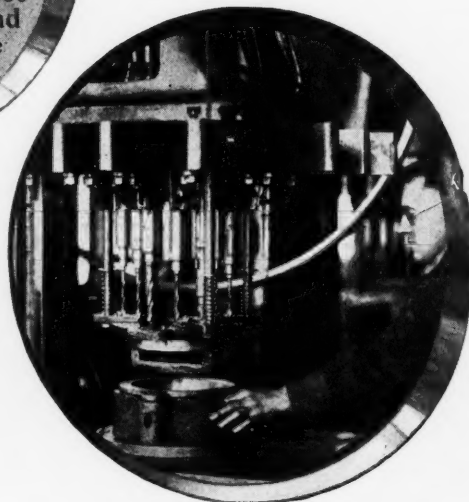


Illustration shows jig (which is attached to spindle head by springs) lifted away from the work.

The complete story of this Cle-Forge High Speed Drill performance has been put into convenient folder form for easy study. May we send you a copy? You will be under no obligation whatever. Simply write "Send me your Digest No. 61".

**The CLEVELAND TWIST DRILL COMPANY**  
CLEVELAND  
NEW YORK-CHICAGO-LONDON  
SAN FRANCISCO  
TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES  
Manufacturers of Carbon and Cle-Forge High Speed Drills for every purpose; "Mezzo" Super-Carbon Drills; Hand, Jobbers' and Shell Reamers; "Peerless" High Speed Reamers; "Paradox" Adjustable Reamers; "Quick-Set" Reamers; "Spirex" Machine Taper Pin Reamers; Chucking Reamers for Turret Lathes; Counterbores; Countersinks; Sockets; End Mills; and the "Ezy-Out" Screw Extractor.



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## One of the most difficult jobs in automobile production

Crank shaft drilling is regarded as one of the very difficult problems in automotive manufacture. The production obtainable on the Barnes horizontal duplex crank shaft machine is limited only by the productive capacity of the drills employed.

Our engineers are especially well prepared to recommend the correct equipment for turning out high class work on a production basis.

*May we have your inquiries?*

The length of the crankshaft is 37 7/8 in. Holes drilled (as shown) are 1 3/8 in. diam. and approx. 3 3/4 in. deep. Material specifications are: drop forged steel S.A.E. 1040. Brinell hardness 241-269.



W. F. & John Barnes No. 430 Horizontal Duplex Drilling Machine for drilling all throws in the six cylinder automobile crankshaft illustrated above. Oil gear feed is used, having an automatic cycle of quick approach, slow feed, and quick return. Three throws are drilled from either end.

Established 1872

# W.F. and John Barnes Co.

ROCKFORD, ILLINOIS

PRODUCTION DRILLING MACHINES

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# KEMPSMITH

## PERFORMANCE IS PROOF

Kempsmith manufactures a complete, modern line of milling machines.

Kempsmith machines are especially designed to meet today's demand for high production, with extreme accuracy.

And Kemp Smith construction is unusually rigid, powerful and rugged—to withstand severest milling.

That is why the present day preference is for Kemp Smith.

The above job for example: removed 67.5

cubic inches of steel per minute. Not for a few cuts only. But constantly for a five day run; actual production over a full proving period.

Moreover, no exceptional strain was noticeable, no vibration, no chatter. The Kemp Smith machine handled this heavy cut with ease, as well as dispatch and accuracy.

Write now for the interesting new Kemp Smith Catalog: "Performance Is Proof."

THE KEMPSMITH MANUFACTURING CO.  
MILWAUKEE . . . WISCONSIN . . . U. S. A.

*Milling Machines for Forty Years—Now Going Bigger Than Ever*

The Measure  
of a production  
tool is the qual-  
ity and quantity  
of the work it does.

## MORSE

Drills, Reamers, Cut-  
ters, Taps and Dies—  
*both high speed and  
carbon*, invite com-  
parison on this basis.

They are the result of  
over half a century of  
tool-making experience.

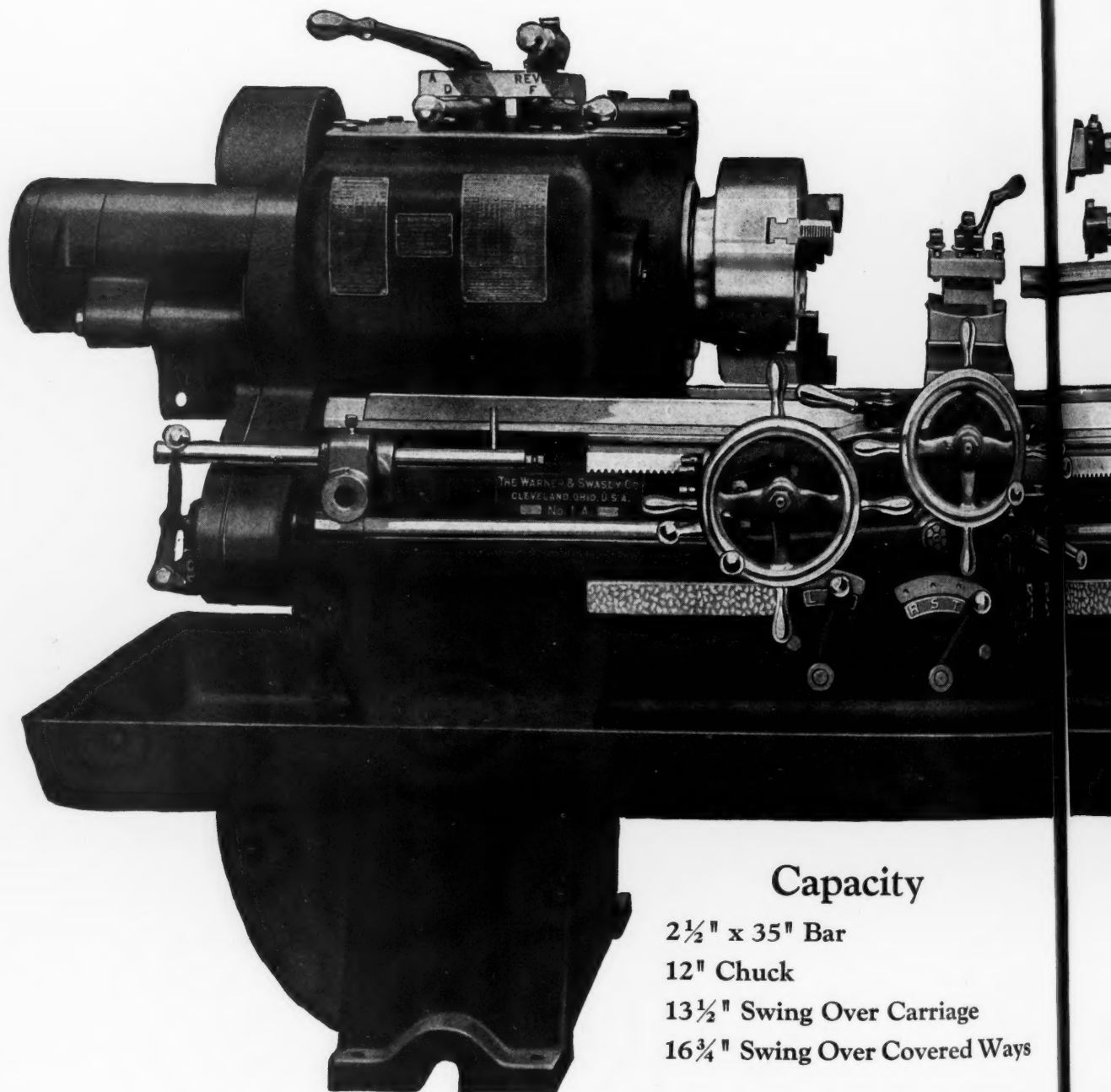
**MORSE**  
TWIST DRILL & MACHINE CO.  
NEW BEDFORD, MASS., U.S.A.



# MORSE

**Carbon & High Speed Tools**  
**Sold by Reliable Dealers Everywhere**

# *The* New W & S 1-A T



## Capacity

- 2½" x 35" Bar
- 12" Chuck
- 13½" Swing Over Carriage
- 16¾" Swing Over Covered Ways

## Bed-Ways entirely



# A Turret Lathe



*Timken Roller Bearing  
Equipped*

**The Warner & Swasey Co.**  
Cleveland, Ohio, U. S. A.

**New York:** Singer Building  
**Chicago:** 618-622 Washington Boulevard  
**Detroit:** 5928 Second Boulevard  
**Philadelphia:** 5143 Spruce Street  
**Boston:** Chamber of Commerce Building  
80 Federal Street  
**Buffalo:** Iroquois Building  
**Pittsburgh:** Chamber of Commerce Bldg.

**Syracuse:** 108 Grant Avenue  
**Milwaukee:** 1143 Wells Building  
**Dayton:** 518 Mutual Home Building  
**Los Angeles:** 228 Central Avenue  
**Indianapolis:** 38 North Bolton Street  
**St. Louis:** 108 North Kingshighway  
**Dallas:** 4915 Victor Street

## Protected at all times

# A hundred thousand times a day

**A** Chuck may spin around on the spindle of a high speed drill. Think what it means to the bearings—to the spindle and even to the motor on your portable tool to have that chuck balanced and accurate. You can't afford to use unwieldy, unbalanced, inaccurate chucks on to-day's drilling machines—they are time wasters, drill breakers and drilling equipment wreckers.



Every Jacobs Chuck is balanced and accurate and whether you specify "Ball Bearing Super", "Plain Bearing Improved" or "Keyless Portomatic" it will pay you to replace old, obsolete chucks with the newly designed and standardized models in the Jacobs line. They are described in Catalog Number Twenty-five and stocked by mill supply dealers everywhere.

THE JACOBS MANUFACTURING CO.  
HARTFORD, CONN.

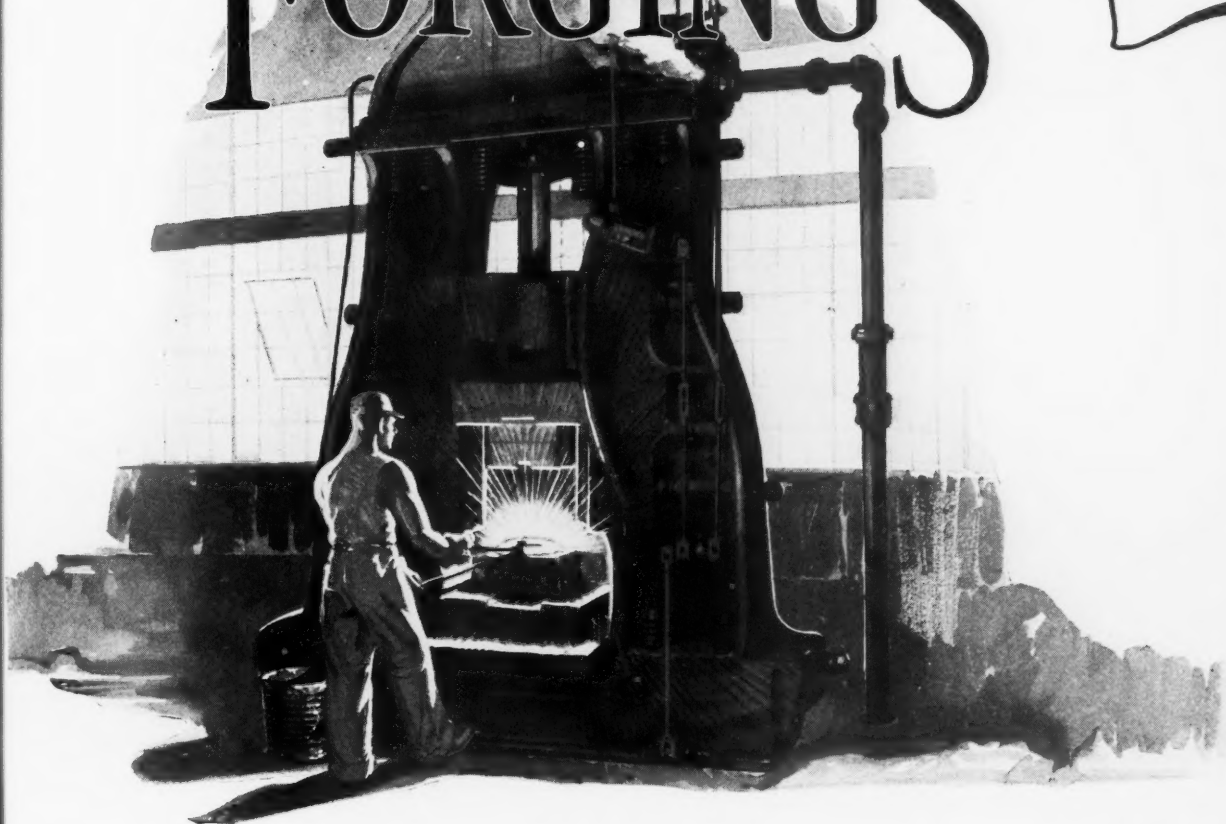
*Makers of*

THE JACOBS  
*Ball Bearing*  
SUPER CHUCK

THE JACOBS  
*Improved Type*  
PLAIN BEARING CHUCK

THE JACOBS  
*Keyless Type*  
PORTOMATIC CHUCK

# FORGINGS



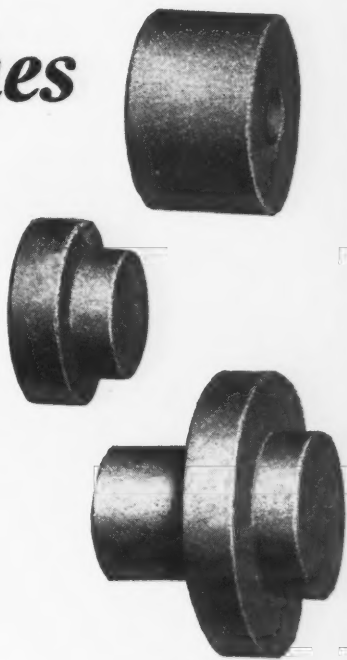
## for ACME Turret Lathes

Accuracy — Dependability — and Efficiency are bywords for Acme Turret Lathes. The complicated yet extremely well designed heads in these machines demand that every piece of metal used in them be as small as possible yet up to definite standards as to strength and durability. They demand the most out of metal that modern science can produce. The result — our forgings are used.

Our metallurgists, experts in the analysis of steel, test every bit of steel used, and our highly trained operators with the help of the most modern hammers produce forgings that stand up under the strains of pull, pressure and heat.

We will be glad to quote you on

Drop Forgings Flat Hammer Forgings Upset Forgings  
Forged Bars Weldless Rings Gear Blanks  
Miscellaneous Forgings of all Descriptions



Typical Forgings  
furnished for  
Acme Turret Lathes

## GEARS AND FORGINGS INCORPORATED



GENERAL OFFICES

**CLEVELAND - OHIO - U.S.A.**

District Sales Offices: Buffalo, Pittsburgh, Detroit, Chicago

Send Blue Prints to Gears and Forgings Inc.

RES

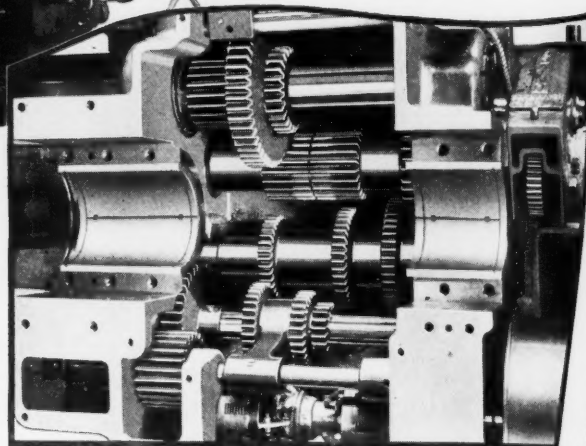
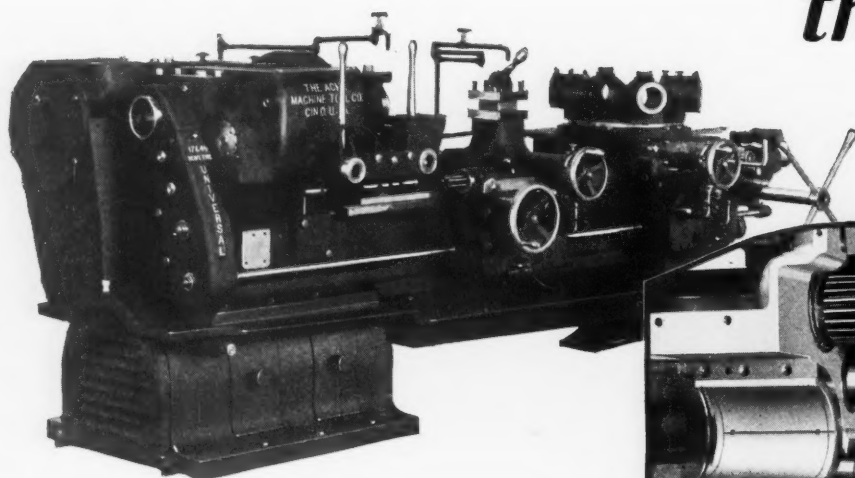
R.C.

OTH

very



# ~ the finished Gears a feature of the Lathe



**T**HE performance of these lathes depends greatly on the all geared head with its multiple splined alloy steel sliding gear transmission—providing nine forward and reverse spindle speeds. In turning these gears over to us to produce, Acme gave us a heavy responsibility.

How well we came through is attested by the results of the lathes. The all geared head is one of its biggest selling features. Our expert knowledge of gear design and manufacture applied to any particular problem results in gears that fit the job so well that the gear set becomes a talking point.

Perhaps we can do as much for you. We will be glad to work with you.

View Showing  
G & F Gears  
in the all  
geared head

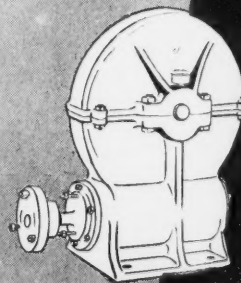
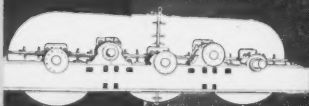
## GEARS AND FORGINGS INCORPORATED



GENERAL OFFICES

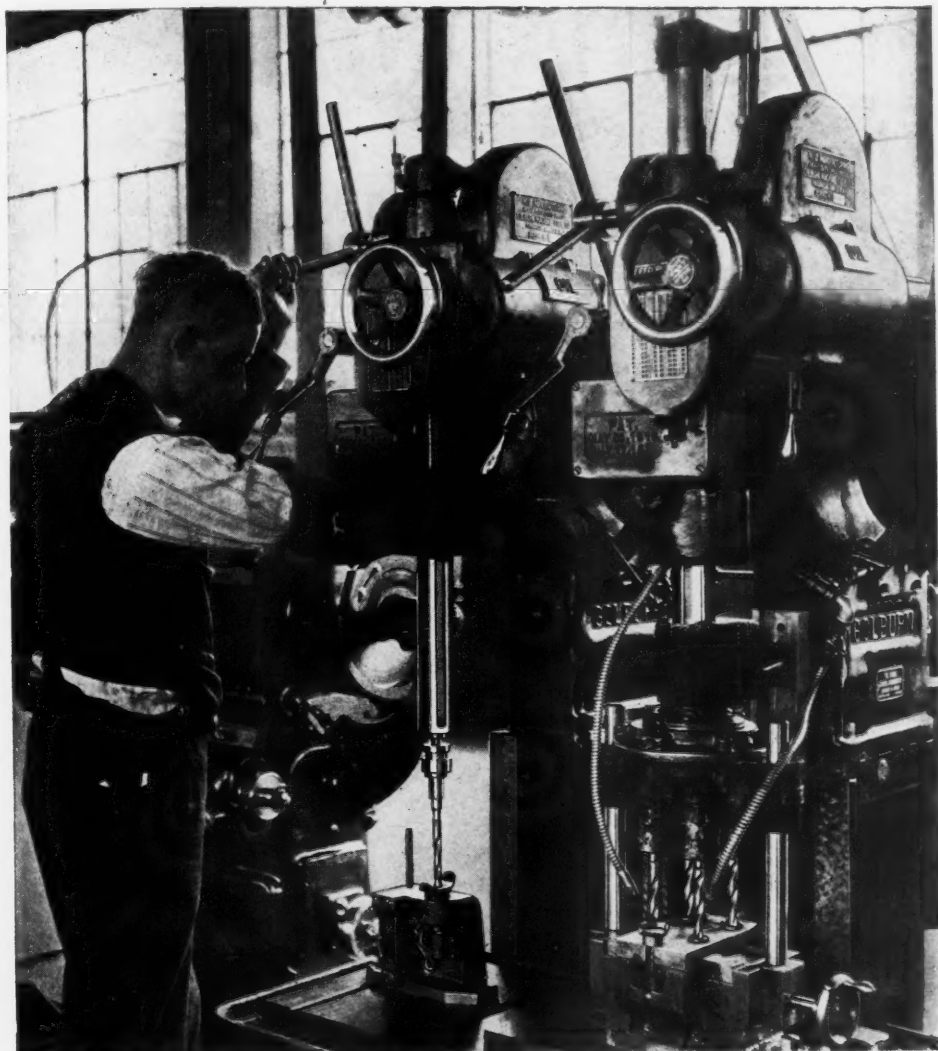
**CLEVELAND • OHIO • U.S.A.**

District Sales Offices: Buffalo, Pittsburgh, Detroit, Chicago

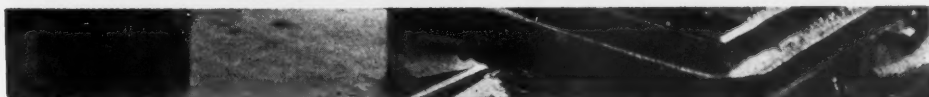


Direct  
Very  
Right  
Com  
and  
Her  
Spec  
Red

# A COLBURN . . . for speed

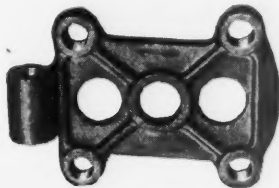


ASK US TO SHOW YOU WHAT EFFICIENT DRILLING MEANS



ONE of the prominent Motor Car Manufacturers has capitalized the speed of the COLBURN in turning out these steel rear axle spring clamps—25 pieces an hour. Five holes, four of them  $17/32$  in. diameter, the other  $5/8$  inches diameter are drilled in each piece. Spindle speed 400 r.p.m., feed .008".

Drilling as fast as this is one sure way to reduce production costs.



When you find COLBURN Heavy Duty Drill Presses used in great numbers in high production shops like Packard, Dodge, Chevrolet, Westinghouse, General Electric, Buick and hundreds of other leading plants, you can be certain there is a dollar and cents reason for it.

Let us know what sort of drilling you are doing . . . we may be able to help you more than you suspect.

BETTS . . . NEWTON . . . COLBURN . . . HILLES & JONES . . . MODERN  
**CONSOLIDATED**

CONSOLIDATED MACHINE TOOL CORPORATION of AMERICA, Rochester, N. Y.

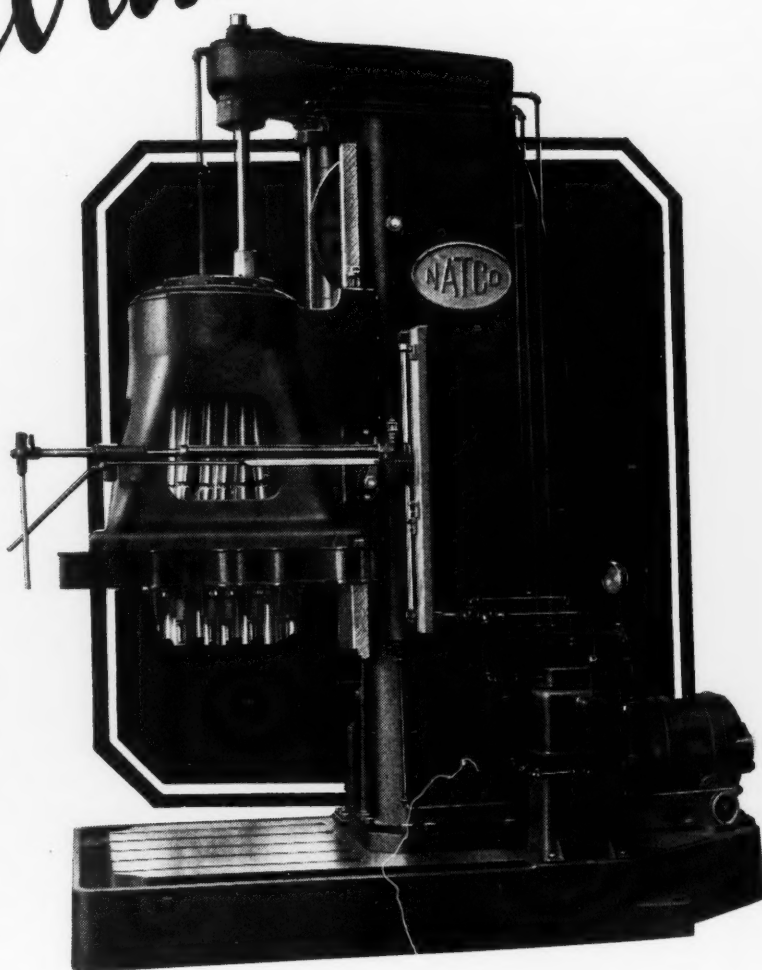
# NATCO *Hydraulic*

## Model C20 HYDRAULIC MULTIPLE DRILLER

The Model C20H is a heavy duty hydraulic feed, multiple spindle driller, designed for production drilling of large holes. The entire machine is unusually rugged in construction and cascade lubrication and frictionless bearings insure long life with little attention.

Although this is the largest standard vertical in the NATCO line, it is one of the simplest of our machines to operate. The control of the feed is through two handles at the front of the head in a position convenient to the operator.

The rate of feed as well as the length of stroke is instantly adjustable. Machine has a capacity of 14—1-in. drills in cast iron at a heavy feed.



### NATCO PRODUCTS

Standard Adj. Multiple	Drill Heads
Fixed Center Multiple	Universal Joints
Single Purpose Automatic	Quick Change Holders
Hi-Duty Single Spindle	Rotary Tables
Horizontal Duplex Drills	Fixtures
Drillers—Tappers—Special Machines	

*May we give you a proposition on your holes?*



THE NATIONAL AUTOMATIC TOOL CO.  
RICHMOND, INDIANA, U. S. A.



# NATCO

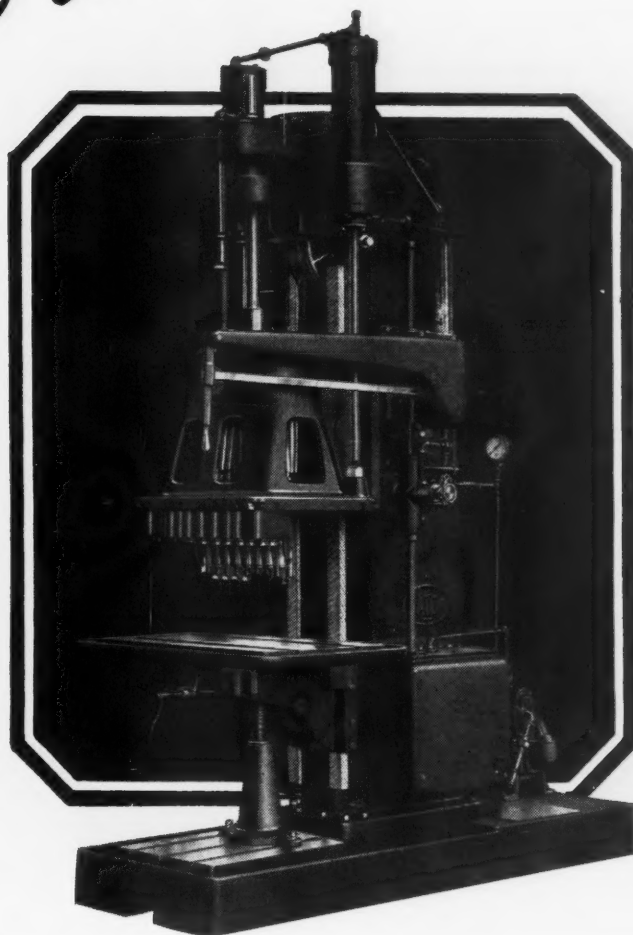
## Hydraulic

### Model C13 HYDRAULIC MULTIPLE DRILLER

The Model C13H is the smallest vertical multiple spindle driller built by NATCO with a Hydraulic Feed. This machine is unusually rugged in construction, cascade lubrication and frictionless bearings being used to insure long life with little attention.

The control of the feed is simple and positive and was designed to leave a minimum of work for the operator. One lever within easy reach at all times completely controls the machine.

Machine has a capacity of 12— $\frac{1}{2}$ -in. drills in cast iron at a heavy feed.



#### NATCO PRODUCTS

Standard Adj. Multiple	Drill Heads
Fixed Center Multiple	Universal Joints
Single Purpose Automatic	Quick Change Holders
Hi-Duty Single Spindle	Rotary Tables
Horizontal Duplex Drills	Fixtures
Drillers—Tappers—Special Machines	

*May we give you a proposition on your holes?*

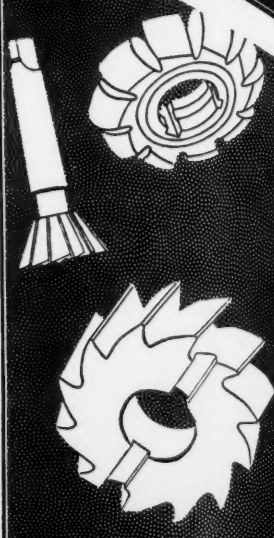
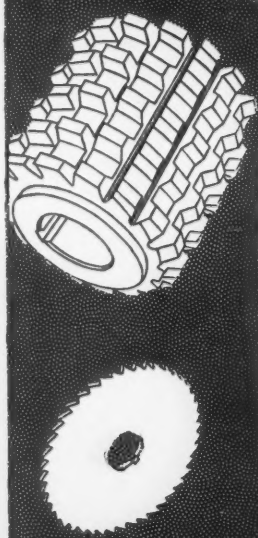
THE NATIONAL AUTOMATIC TOOL CO.  
RICHMOND, INDIANA, U. S. A.

# NATCO



# SUCCESS

The constant effort of the National Twist Drill and Tool Company during twenty-five years of small tool manufacture, has been to produce tools that will aid in making your business a success.



TWIST DRILLS · REAMERS · HOBS · MILLING CUTTERS · SPECIAL TOOLS  
**NATIONAL TWIST DRILL & TOOL COMPANY**  
 DETROIT, U. S. A.

## BRANCHES

NEW YORK, N. Y.  
274 Lafayette St.

PHILADELPHIA, PA.  
43 North Sixth St.

CHICAGO, ILL.  
26 S. Jefferson St.

CLEVELAND, O.  
709 St. Clair Ave. N. W.

SYRACUSE, N. Y.  
107 Gifford St.

BUFFALO, N. Y.  
76 Pearl St.

INDIANAPOLIS, IND.  
25 W. South St.

# SPRINGFIELD

## Ball Bearing Geared Head ENGINE LATHES

### Profitable on All Turning

The performance of Springfield Lathes has earned the praise of owners in all lines, on all kinds of turning. They meet the strictest standards of precision, combining a native accuracy with high productive powers and an economy of operation that cannot fail to contribute a liberal acceleration to profits.

Springfields are priced high enough to include the best features of modern lathe construction, yet they are within the range of the smaller plant. Put these Springfield superiorities to work for you:—

**Twelve speeds, directly selected, from 14 gears. No idle gears ever in mesh.**

**All journals (except main spindle) ball bearing, including thrust.**

**Noiseless and chatterless head, free from vibration.**

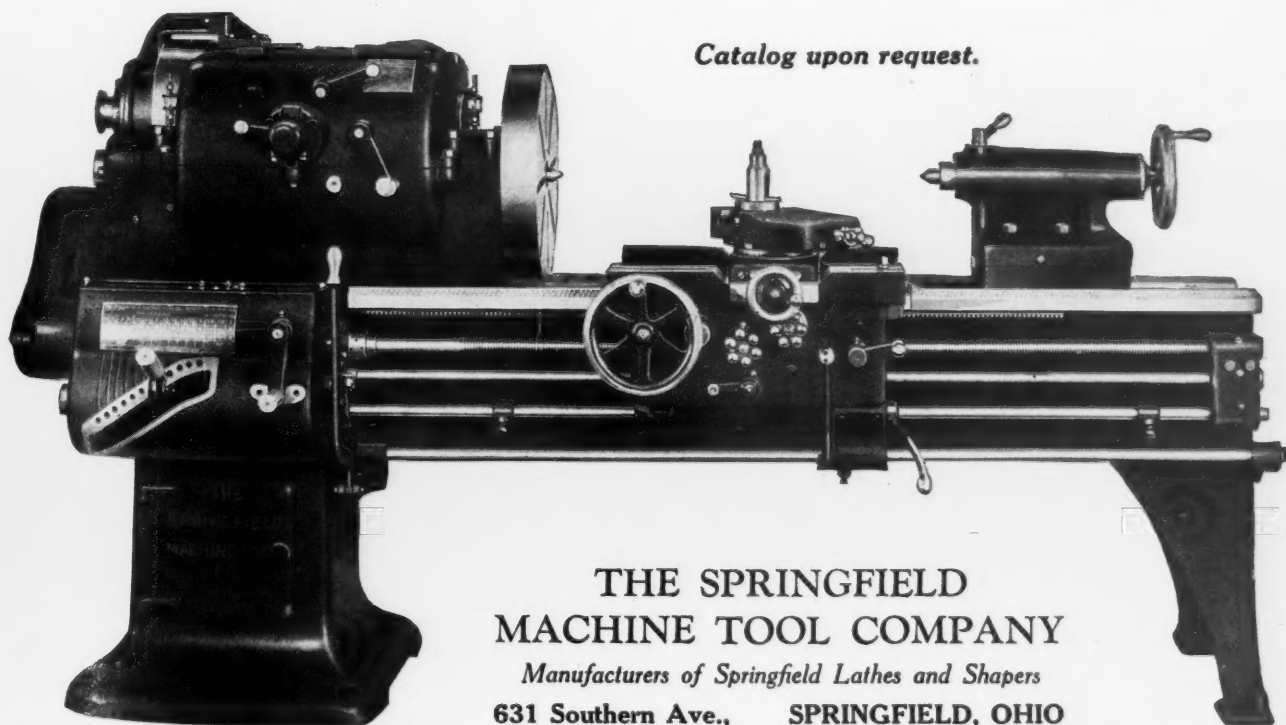
**Handy adjustment of main spindle bearing without removing cover or caps.**

**Concentrated control.**

**Greater accuracy—production. Less power consumption.**

**Aren't they worth investigating?**

*Catalog upon request.*



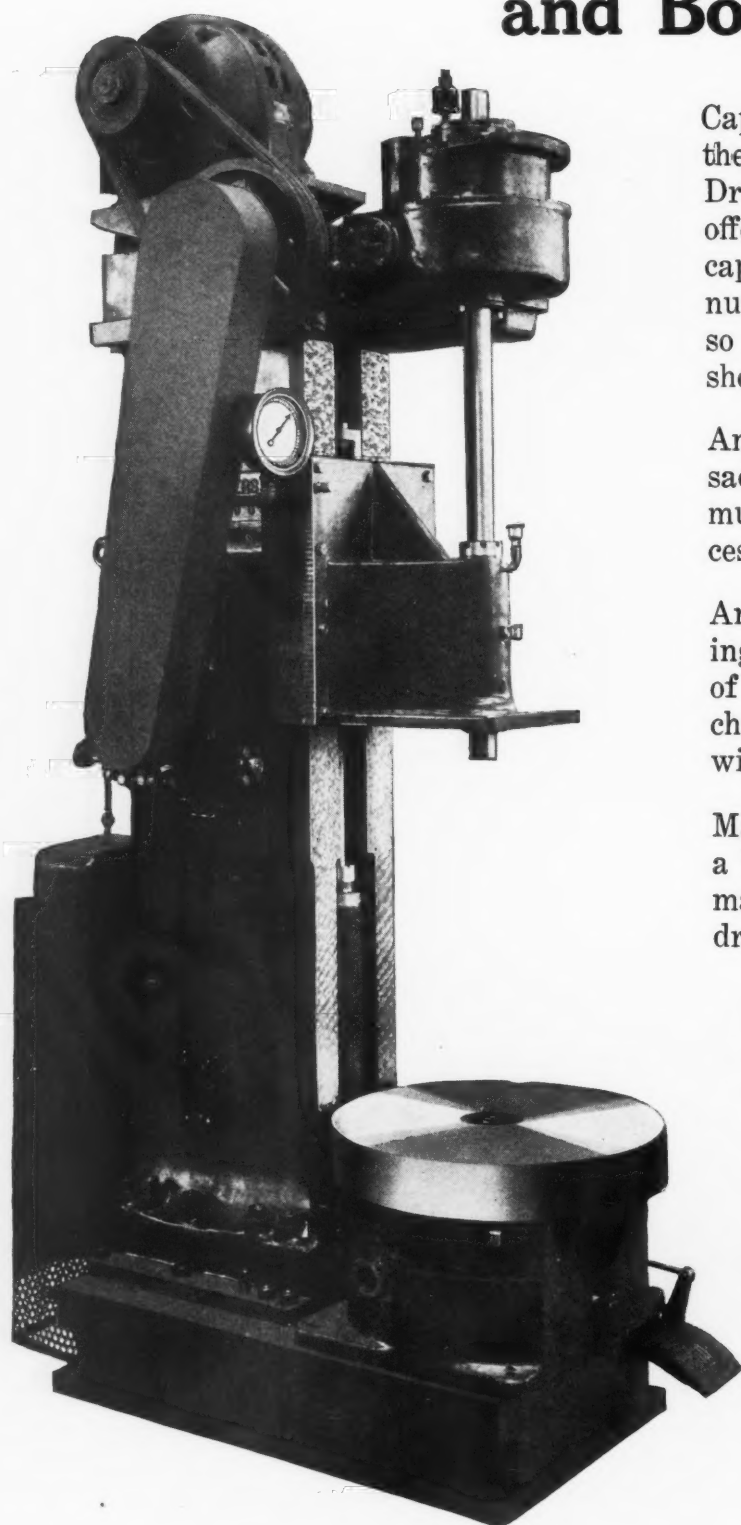
**THE SPRINGFIELD  
MACHINE TOOL COMPANY**

*Manufacturers of Springfield Lathes and Shapers*  
**631 Southern Ave.,    SPRINGFIELD, OHIO**



# BAKER No. 10 H

## Hydraulic Feed Drilling and Boring Machine



Capacity 2" High Speed Drill in Steel, or the Equivalent for Boring or Multiple Drilling Operations. This machine is offered to meet the demand of a lighter capacity hydraulic feed machine than our number 25 H, or 50 H that have proved so popular and successful in production shops during the last three years.

Any type of head can be attached to the saddle, from a single spindle unit to a multiple spindle head for multiple or successive operations.

An OILGEAR pump is provided for the feeding mechanism, embodying its features of automatic rapid advance to the work, changing to any desired feed and rapid withdrawal when finishing the cycle.

Machine is furnished only for motor drive, a Tex rope drive being furnished for the main drive, the hydraulic pump being driven by the same motor through a belt.

Send us your drilling and boring problems and we will gladly show you what this equipment can produce on your work.

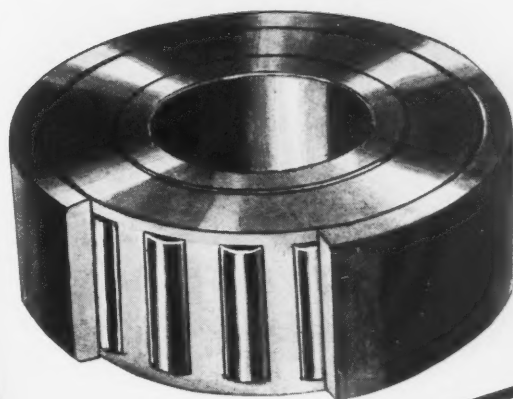
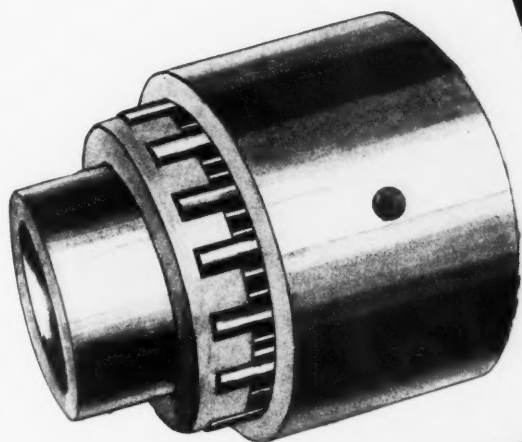
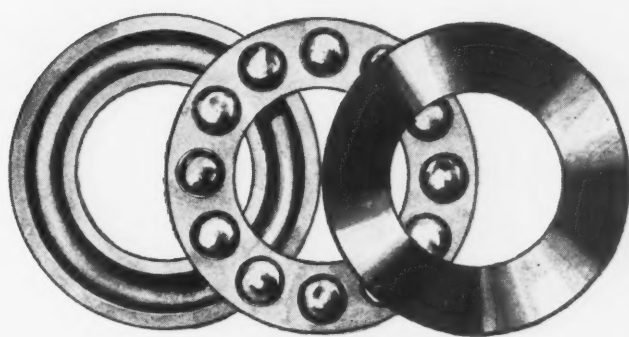
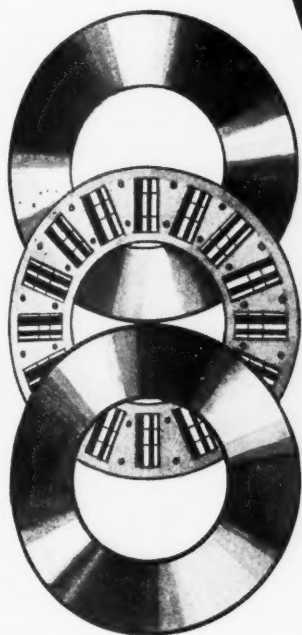
No. 10 H,  
Hydraulic Feed  
Machine

*with indexing table (note  
flanged head construction  
to which multiple head is  
to be attached.)*

### BAKER BROTHERS, Inc., Toledo, Ohio, U.S.A.

Builders of Boring, Drilling, Tapping, Keyseating and Slotting Equipment

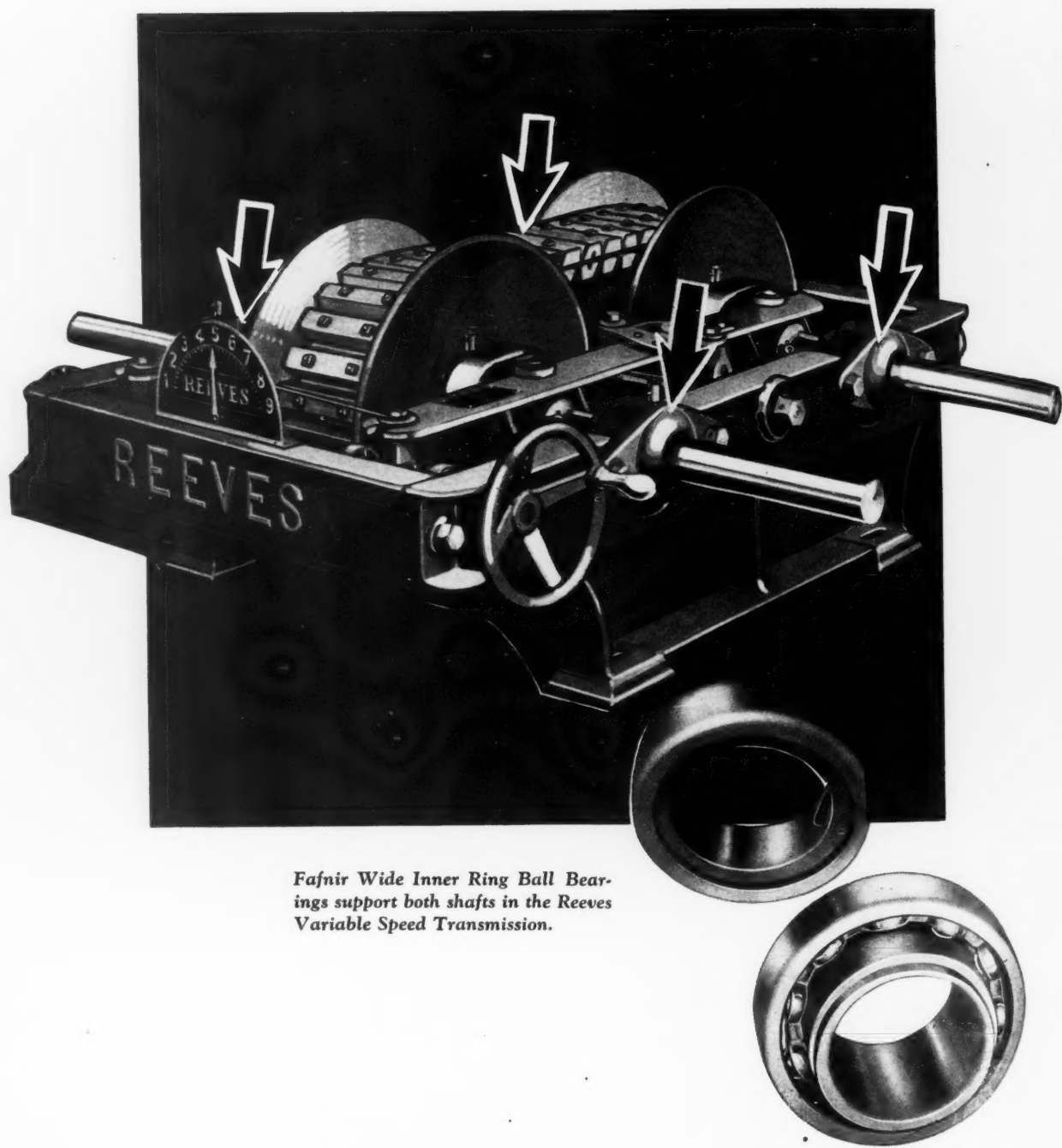
Reliability  
Efficiency  
Durability  
Quality



**Ball & Roller Bearings**  
THE BALL & ROLLER BEARING COMPANY  
DANBURY, CONN., U. S. A.

Send for  
Catalog No. 11  
and Price List.

# Reeves Uses Fafnirsto



*Fafnir Wide Inner Ring Ball Bearings support both shafts in the Reeves Variable Speed Transmission.*

## THE MOST COMPLETE LINE OF



rsto gain . . . . .

## *Ball Bearing efficiency with plain bearing simplicity*

**S**TRENUOUS 24 hour-a-day service—intense heat—dust and abrasive dirt—these are conditions imposed on Reeves Variable Speed Transmission. For this severe duty Reeves engineers specified Fafnir Wide Inner Ring Ball Bearings because they required “Simplicity of mounting—durability and efficiency.”

Fafnir Wide Inner Ring Ball Bearings rival plain bearings in simplicity of mounting. The Wide Inner Ring is slid over the shaft—a turn of the self-locking collar secures it in place. Adapters, shaft shoulders, locknuts and sleeves are abolished.

With this simplicity is combined the lasting anti-friction qualities of ball bearings; positive protection against shocks and heavy loads, both radial and thrust, and the elimination of wear. Then, too, the tightly sealed housings prevent lubricant leakage and protect the bearings from abrasive dust and dirt.

Give your machines the benefits of ball bearings and profit by the ease of mounting which only Fafnir Wide Inner Ring Ball Bearings provide.

THE FAFNIR BEARING CO., New Britain, Conn.  
NEWARK      DETROIT      CLEVELAND      CHICAGO

# **FAFNIR**

## **BALL BEARINGS**

OF BALL BEARINGS IN AMERICA

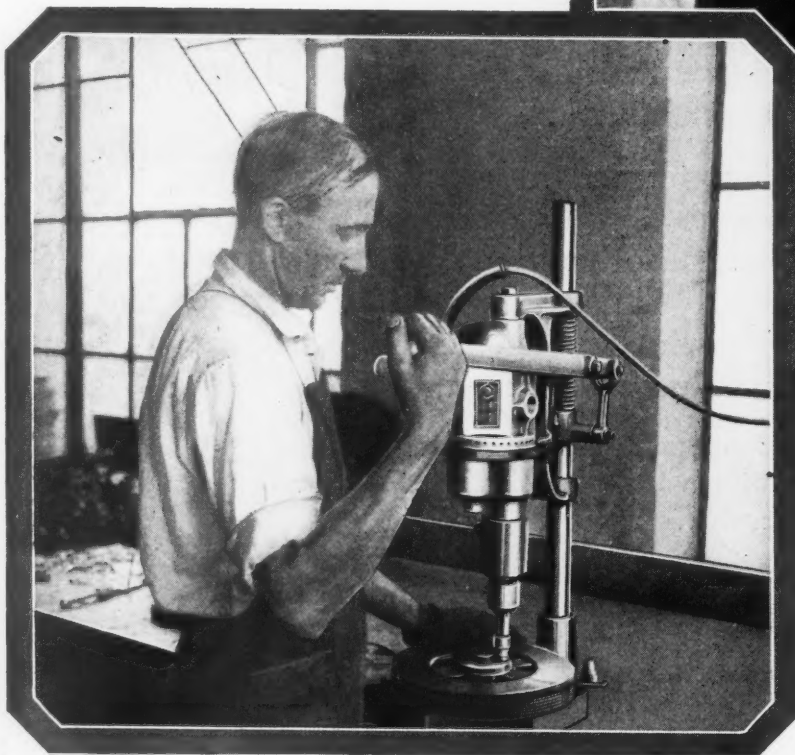
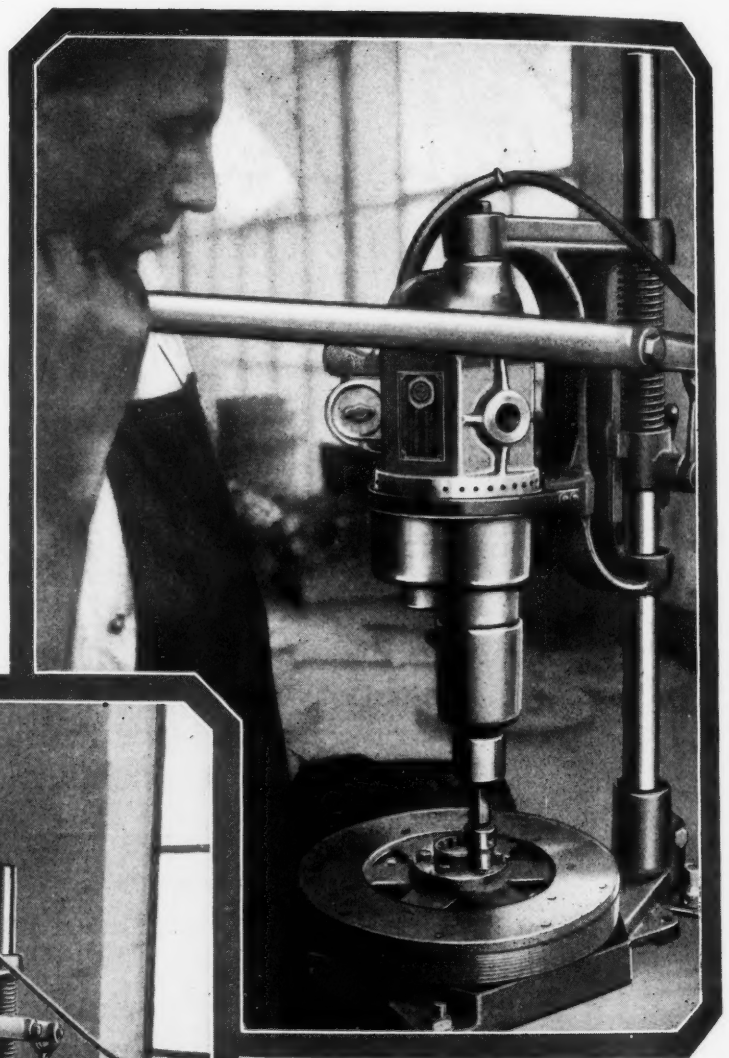
# *Almost Unbelievable!*

**THE LONG MFG. CO.  
OF DETROIT, MICH.,  
says:**

One man with a

**BLACK & DECKER**

Electric Socket Wrench,  
does work that formerly  
required four men



**Black & Decker Reversible Electric Socket Wrench, mounted in Black & Decker Bench Stand, as used for production work in plant of Long Mfg. Co.**

*The* **BLACK & DECKER MFG. CO.**

TOWSON, MD., U. S. A.

Black & Decker Mfg. Co., Limited, Toronto, Ontario

Black & Decker, Limited, Slough, Bucks, England

*Branch Offices with Service Stations in*

BOSTON NEW YORK OAKLAND, CAL. ATLANTA DETROIT BALTIMORE KANSAS CITY LOS ANGELES PITTSBURGH  
BUFFALO PHILADELPHIA ST. LOUIS DALLAS CHICAGO MINNEAPOLIS CLEVELAND SEATTLE INDIANAPOLIS

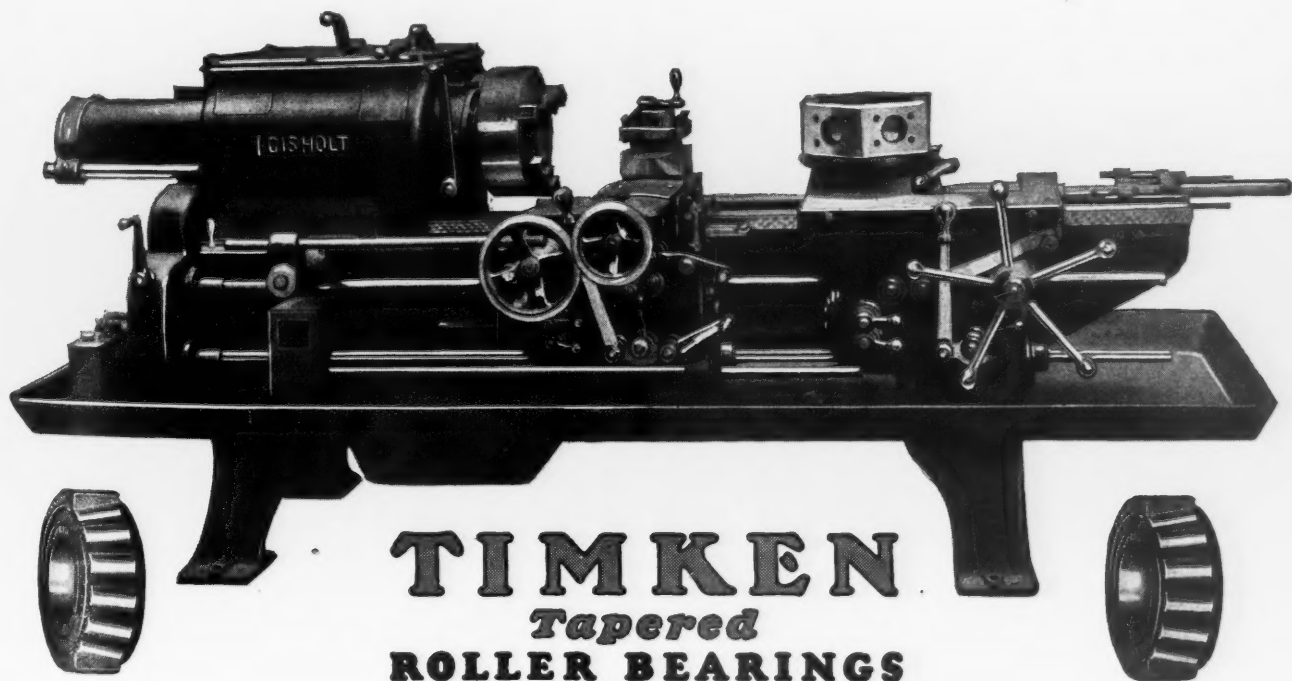
# Gisholt Selects Timkens for High Production

They call it the Gisholt "1L" High Production Turret Lathe. In machine tools today high production very generally means Timken-equipped. This latest Gisholt has Timken Bearings on the drive shaft, intermediate shaft and reverse shaft, and on the spindle itself.

Thus Gisholt puts its seal on the fact that utmost production, precision, rigidity and endurance are made possible by Timken full thrust-radial capacity, greater load carrying area, and excellent anti-friction properties. Timkens not only reduce operating and maintenance costs, but help to improve the character of the output and the production totals.

Timkens help to keep machine tools perfect, fast, and economical for many extra years—because Timkens combine Timken tapered construction, Timken *POSITIVELY ALIGNED ROLLS*, and Timken-made electric steel.

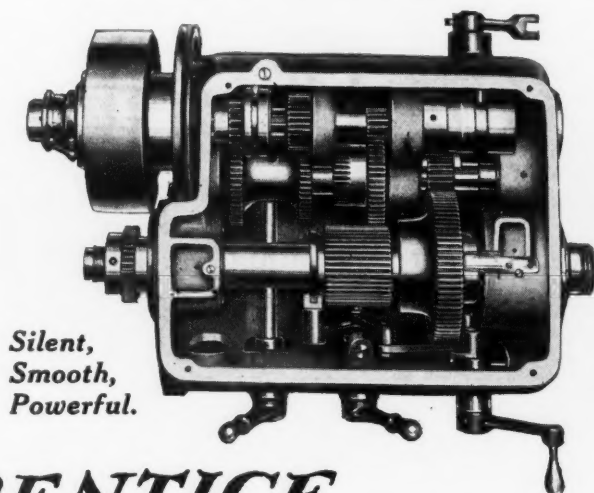
THE TIMKEN ROLLER BEARING CO.  
C A N T O N , O H I O





*Features  
of the  
New*

## The Headstock



# REED-PRENTICE *Sliding Gear Head* LATHES

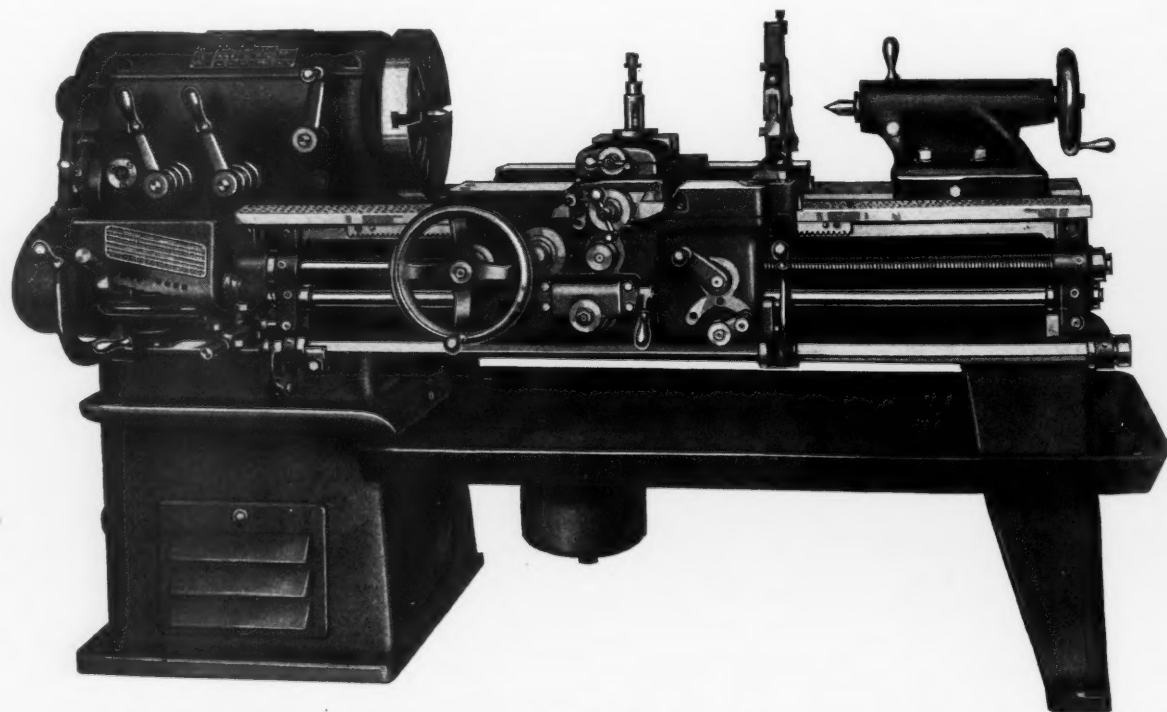
The Headstock is the most vital unit in the assembly of lathe elements, and we have spared no designing and construction expense to insure its dependability.

*A silent, smooth and powerful sliding gear transmission.* Extreme simplicity secured through the use of the least number of working parts—only nine gears for eight spindle speeds.

Gear teeth are accurately cut and burnished before and lapped after hardening. Gears are nickel chromium S.A.E. No. 3250 electric furnace steel, hardened. Gears slide on multiple spline shafts of heat treated nickel chromium steel and run in bath of oil.

Spindle is S.A.E. No. 3140 heat treated nickel chromium alloy steel running in four Precision TIMKEN bearings. Back shafts run in radial ball bearings.

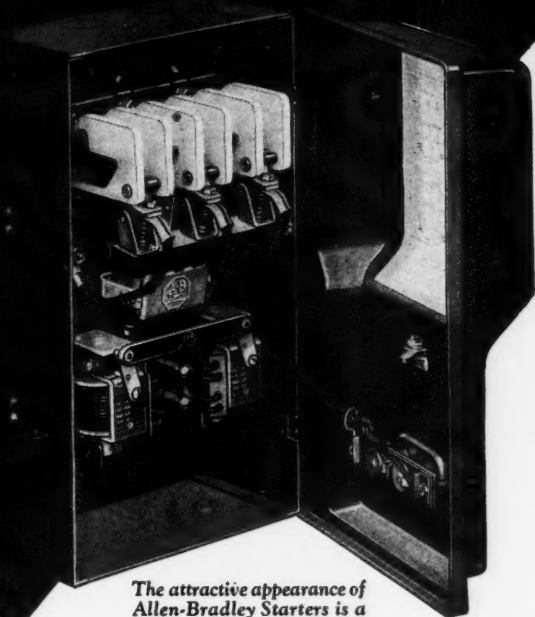
Main drive pulley provided with disc clutch and brake. Materials and construction as high grade as any quality automobile transmission. *Circular 10-314-16 interestingly details all parts of this new lathe. Get it.*



**REED-PRENTICE CORPORATION, Worcester, Mass., U.S.A.**

New York Office:—1508 Evening Post Bldg., 15 West St., New York, N. Y.  
Detroit Office:—3-245 General Motors Bldg., Detroit, Mich.

# 5 Big Reasons FOR ADOPTING



The attractive appearance of Allen-Bradley Starters is a sales asset to any machine

1. Both A. C. and D. C. Starters are made in 3 forms, providing lowest installation cost for every possible operating requirement.
2. The interchangeable mounting dimensions of A. C. and D. C. Starters of popular ratings permit the use of uniform mounting arrangement.
3. The Inducto-therm relays of the A. C. line are adjustable over a wide range of horse power ratings and completely eliminate the nuisance and uncertainty of providing a correct thermal element or heater for a given motor application.
4. The D. C. Automatic Starter provides jerkless acceleration because the graphite compression resistance can be adjusted to exact motor load conditions.
5. Overload relay and no-voltage protection are standard features of all starters.

## Sturdy Construction at Low Cost

Every part of Allen-Bradley A. C. and D. C. Starters is designed to give maximum reliability and service with minimum attention and lowest maintenance cost.

Despite the many unusual advantages of these starters, the price is low.

Write for bulletin describing the many other important features of this attractive line of automatic starters.



**Form 1**  
push buttons  
in cover materially reduce installation cost.



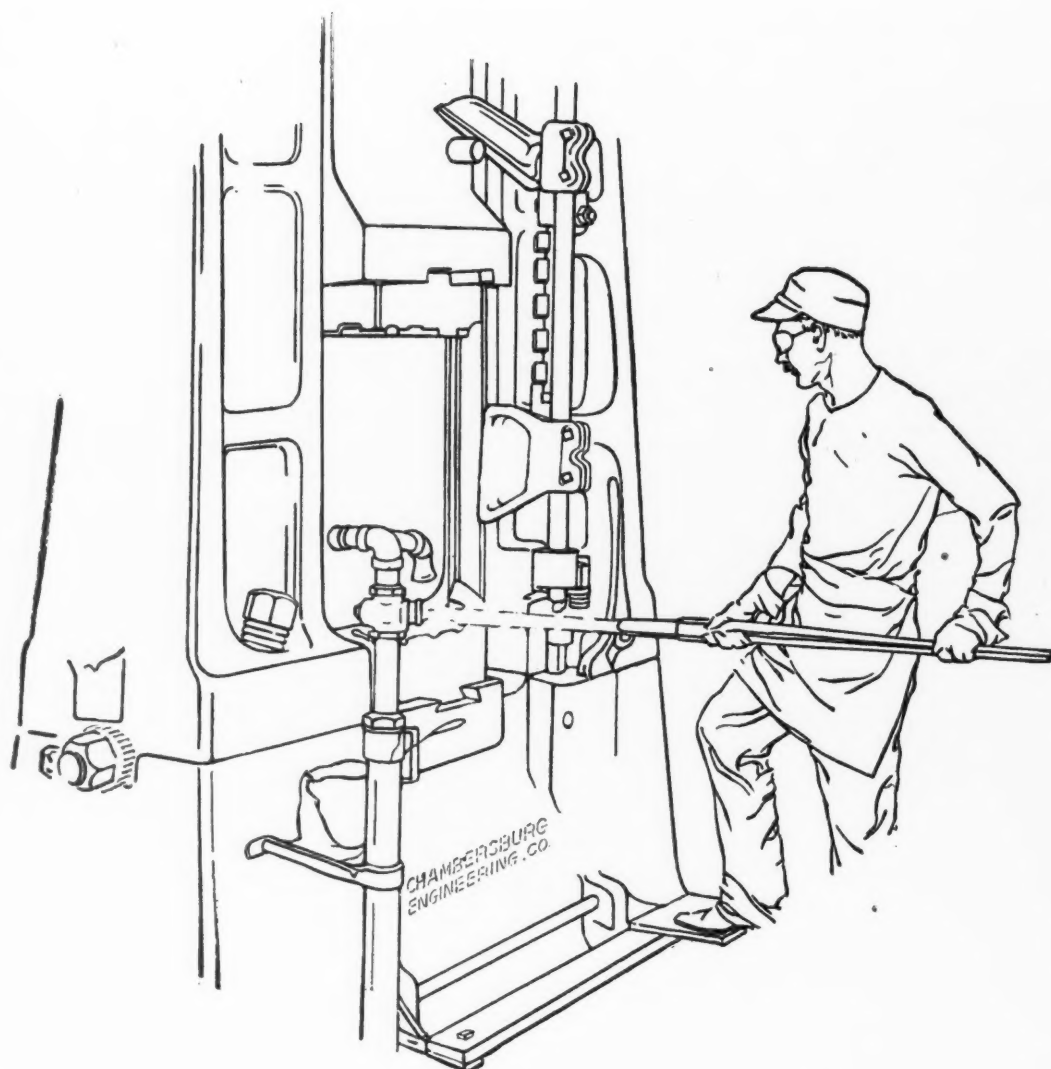
**Form 2**  
operated with  
outside push  
buttons for remote control.



Allen-Bradley Co., 499 Clinton St., Milwaukee, Wis.

# Allen-Bradley Starters





**C**HAMBERSBURG Board Drop Hammers are built as the man in the forge shop wants them, simply and ruggedly, with every possible provision against service interruptions. Their ability to produce more forgings per hour than any other

board hammer is due to our careful elimination of every weakness that would tend to halt production.

Chambersburg aims not only at fewer interruptions but, when unavoidable, shorter ones.

CHAMBERSBURG ENGINEERING CO.  
CHAMBERSBURG, PA.

*Sold by*

**CHAMBERSBURG-NATIONAL**  
COMPLETE FORGING EQUIPMENT

*Sales Offices*

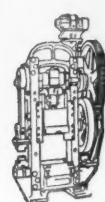
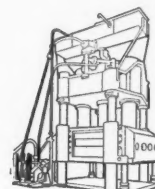
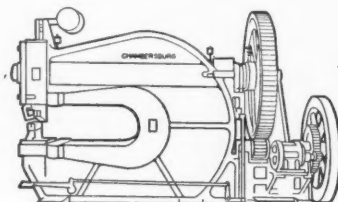
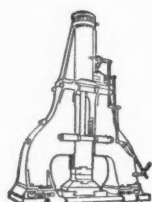
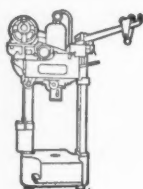
CHAMBERSBURG, PA.  
Derbyshire St.

TIFFIN, O.  
Greenfield & Stanton Sts.

NEW YORK  
152 W. 42nd St.

CHICAGO  
565 W. Washington St.

DETROIT  
2457 Woodward Ave.







# Barber-Colman

*for*  
**Production Milling**

The Barber-Colman better cutters (Slab, Side, Alternate-toothed, Formed—or what have you) have time and again proven their ability to *stand up* and give true *performance* on High Production work. What can *they* do for you?

**BARBER-COLMAN COMPANY**  
GENERAL OFFICES AND PLANT  
**ROCKFORD ILL. U.S.A.**



Above are the dies used in this Acme Forging Machine installation for making conveyor pulley heads (in the center). The blank is shown below the finished heads.

## Versatile and Profitable

The versatility of Acme Forging Machines is well shown by an interesting operation performed in the plant of an eastern manufacturer of tanks, boilers, conveyors and other iron work.

Blanks of hot rolled steel 6½" diameter and 3/16" thick are upset in an Acme Forging Machine to form pulley heads for conveyors. Two men turn out 15,000 of these parts per 10-hour day. Formerly these parts were hot pressed on punch presses, and five men were required to maintain production.

Acme Forging Machines are being profitably employed not only for all the work of the forging shop but upon many special jobs.

*Our Engineers are at your disposal to find the most profitable answer to your forming, upsetting and forging questions.*

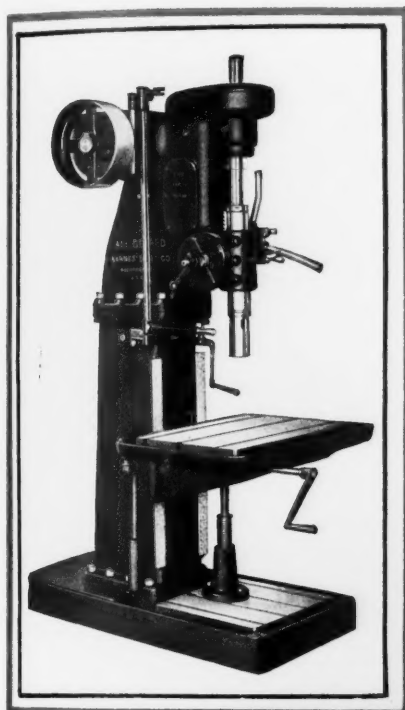
## Acme Machinery Company

Cleveland, Ohio, U. S. A.

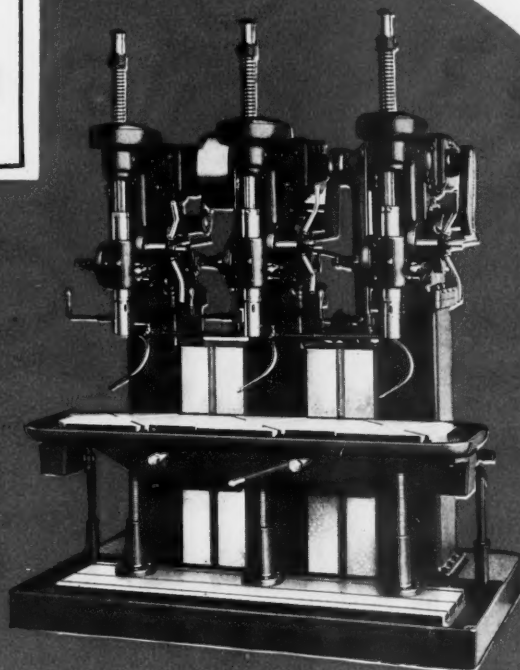
FOREIGN AGENTS: Burton, Griffiths & Co., Ltd., London;  
Glaenzer & Perreaud, Paris, France.

# ACME FORGING MACHINES

# For A *Whole Lot* of Drilling



The No. 210 Self-Oiling All-Geared Ball-Bearing Drill and Tapper; in single spindle or gang types, with or without attachments; is a highly productive machine for a whole lot of drilling. It is a simplified drilling machine, with any single speed and feed desired. Capacity 1½" in steel. It is strong, exceptionally rigid and powerful—possessing the characteristics of design and construction which make our Self-Oiling All-Geared machines notable production increasers, space and labor savers—profit makers.



## ATTACHMENTS

Automatic Reverse for tapping.  
Positive Thread - Leading Feed.  
Automatic Spindle Return with Adjustable Brake Band Stop.  
Cam Feed.  
Power Feed Dwell for Facing.  
And other features, all for increased efficiency and greater productive capacity.

# **210**  
**Self Oiling**  
**All Geared**  
**Drilling Machines**

.....

Send for  
Catalog M

**BARNES DRILL CO.**

814 Chestnut St., Rockford, Ill.



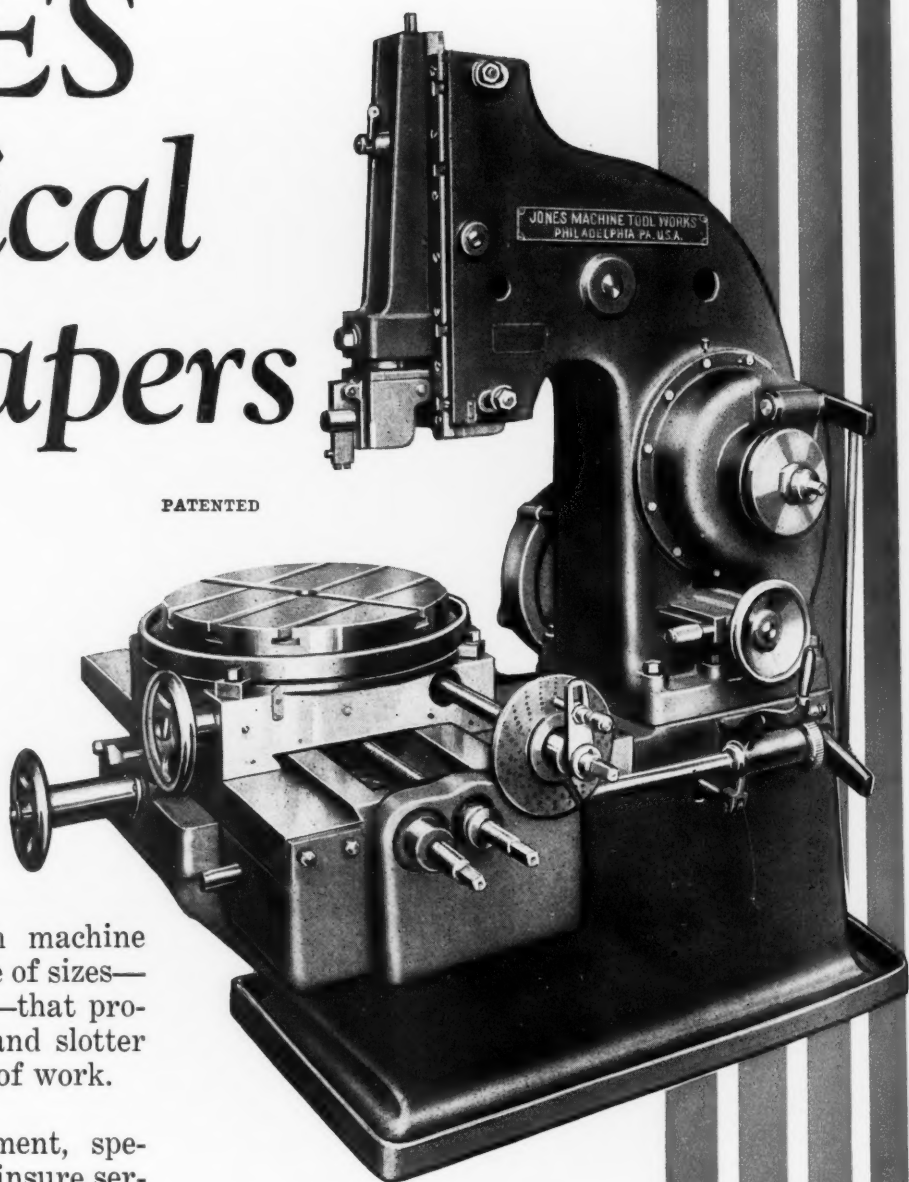
# JONES Vertical Shapers

for  
greater  
range

A line of fine, modern machine tools in an unusual range of sizes—6, 8, 10, 12 inch stroke—that provides the *right* shaper and slotter capacity for every class of work.

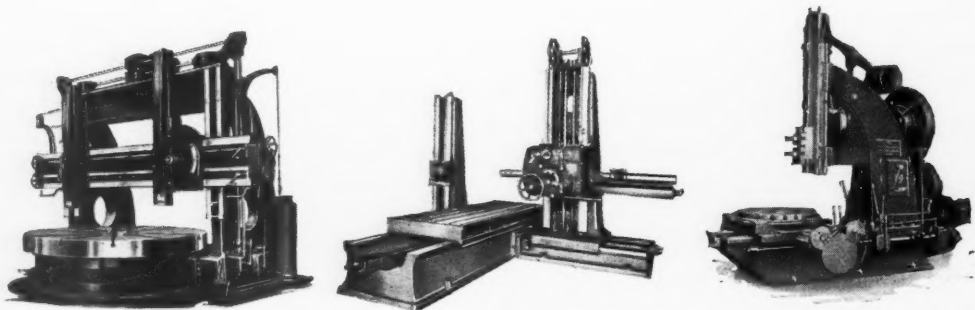
As in all Jones equipment, specially patented features insure service capacity and operating conveniences that eventually reduce production costs.

The reputation of the Jones Lines of Slotters and Vertical Shapers, Horizontal and Vertical Boring Mills indicates the results being obtained by increasing installations in important plants. We'd like to tell you more about them.



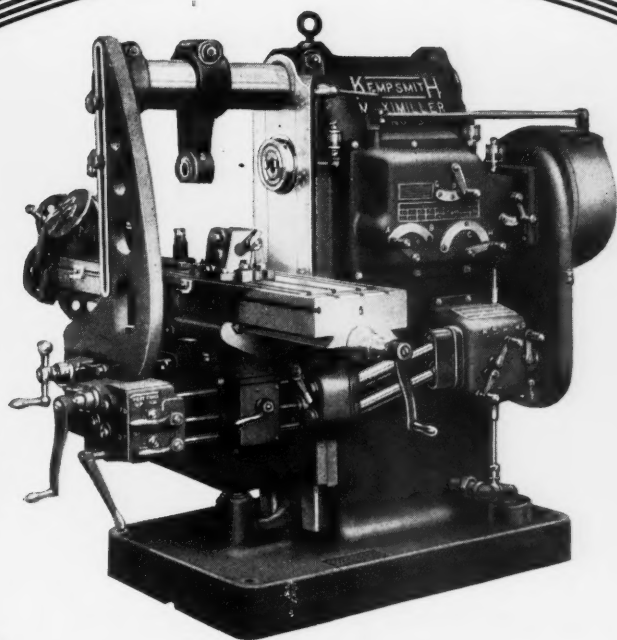
PATENTED

"PACING PRODUCTION SINCE 1922"



**JONES MACHINE TOOL WORKS, Inc.**

53rd and Lansdowne Ave., PHILADELPHIA, PA.



**New Departure  
Equipped**

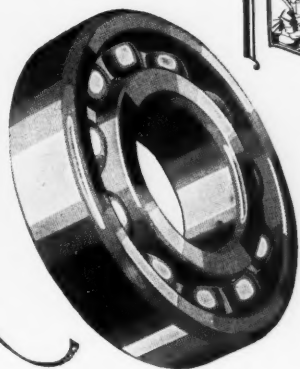
**BACKLASH** is reduced to a minimum in Kemp Smith Maximillers due to perfection of design and methods of manufacture of drive and feed mechanisms.

The original efficiency of such designs is never permanent if bearings supporting the rotating members are subject to wear, for no allowance is ever made for center to center adjustment of spur gear drives.

Kemp Smith engineers have chosen New Departure Ball Bearings for their "Maximill" because the bearings are of superior design, have greatest endurance and extremely long life.

Write for new booklet just published by our Engineering Department entitled "More and Better Production at Less Cost," telling what ball bearings mean to machine tools. Sent on request.

THE NEW DEPARTURE MANUFACTURING COMPANY  
BRISTOL, CONNECTICUT  
Chicago San Francisco Detroit

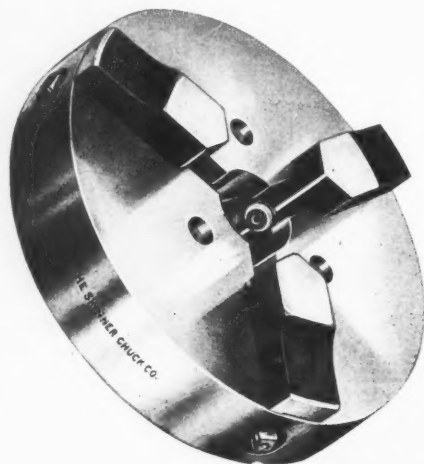


Whenever you have a bearing problem our expert engineers will be glad to discuss it with you personally. We will help you to do your thinking.

**New Departure  
Quality  
Ball Bearings.**



# SKINNER CHUCKS FOR MODERN MACHINE TOOLS

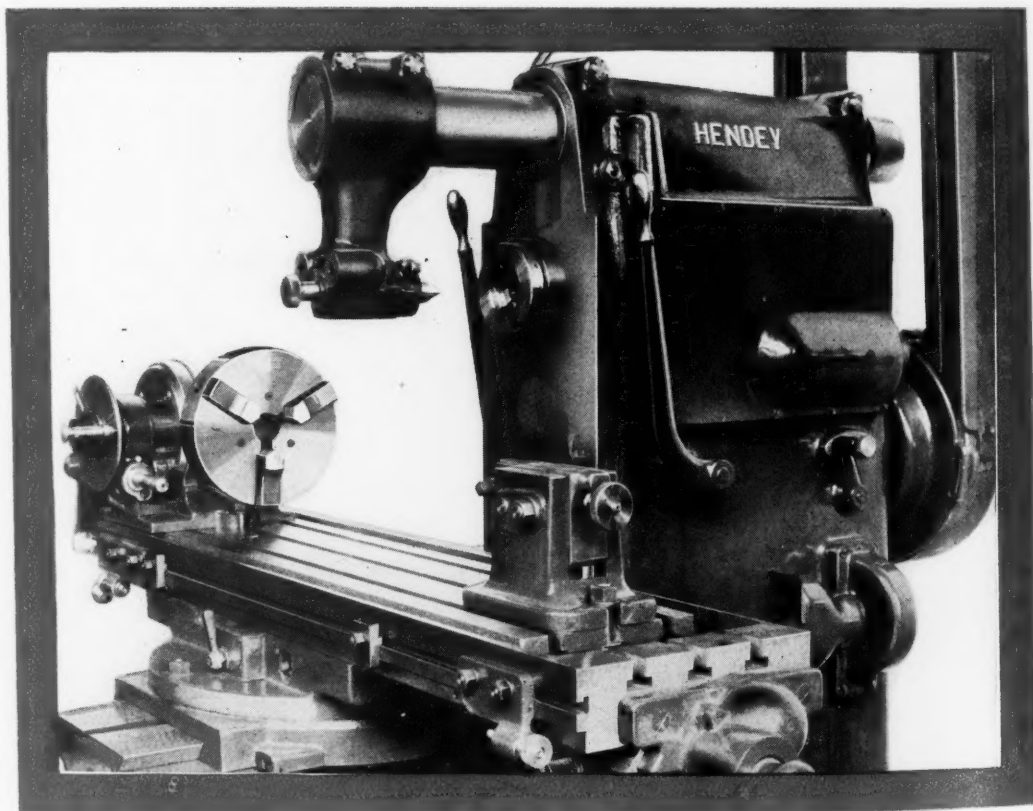


## *Skinner Chucks Match Standards with “HENDEY QUALITY”*

A good machine operates with maximum efficiency only when every item of equipment is its equal in quality.

When Hendey installs a Skinner Geared Screw Universal Milling Machine Chuck on a Hendey Milling Machine they insure the work holding efficiency and accuracy so important to machine tools of this class; they offer guaranteed chuck service—backed by the Skinner reputation and organization.

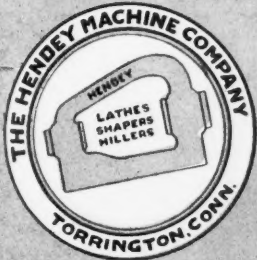
A SKINNER CHUCK  
on the  
HENDEY MILLING  
MACHINE



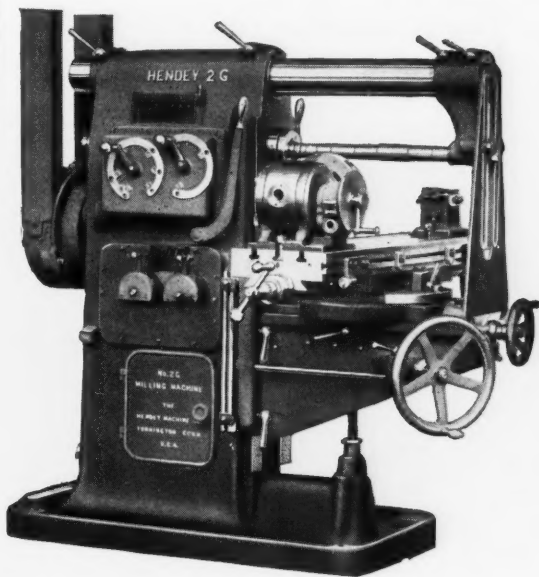
## THE SKINNER CHUCK COMPANY

NEW BRITAIN, CONN. U. S. A.  
LATHE-DRILL-PLANER-CHUCKS  
MANUFACTURERS OF WRENCHLESS “AIR OPERATED” CHUCKS





# HENDEY MILLING MACHINES



1870 • AN IDEAL • 1870  
HENDEY QUALITY  
1928 • A REALITY • 1928

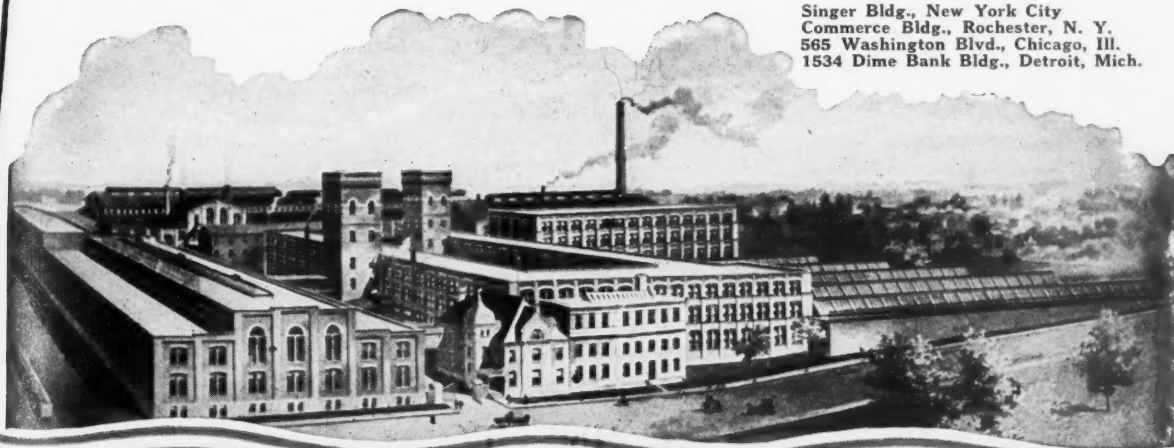
## REPUTATION

The Hendey reputation is bound up with that of the hundreds of plants in which Hendey Machines are in operation; it is built on their satisfaction with Hendey production, their appreciation of Hendey service.

It is created by such machines as the Hendey Model 2 - G Gear Driven Milling Machine. Thoroughly dependable both as to quality of workmanship built into the machine, and capacity for ample production through high operating efficiency—the latter facilitated through the wide range of spindle speeds and feeds, with the gear shafts running in ball bearings and the whole spindle speed gear mechanism operating under automatic lubrication.

**THE HENDEY MACHINE CO.**  
TORRINGTON, CONN., U. S. A.

Singer Bldg., New York City  
Commerce Bldg., Rochester, N. Y.  
565 Washington Blvd., Chicago, Ill.  
1534 Dime Bank Bldg., Detroit, Mich.





"Just  
Pull  
the  
Starting  
Lever"

## GARVIN 2X

### Automatic Tapping Machine

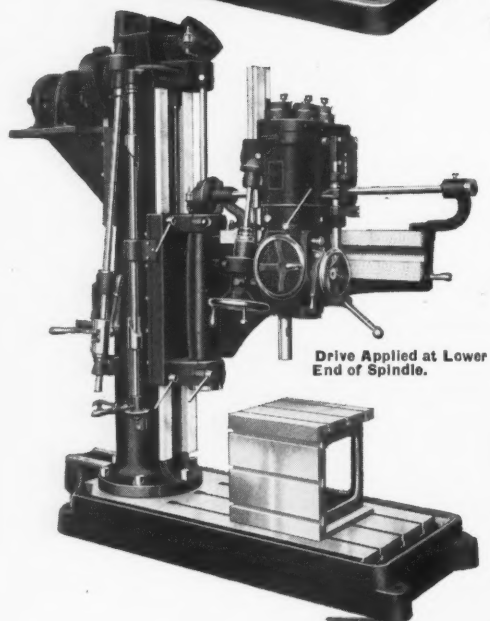
with Speed-Box

*Fosters Economy  
Increases Production*

The installation of a Garvin 2X Tapper in any plant cannot but effect an immediate production increase and a new "low" in the cost of all work within a wide range. Timken Bearings throughout, a new selective type Speed Box, recently installed, the superiority of design, materials and workmanship are reflected in every phase of the machine's performance; economy of lubrication, reduction of tap breakage and sparing use of power.

If you are interested in tapping, you will be interested in the details of the Garvin 2X Automatic Tapping Machine. Your request brings a Catalog.

### Western Radial Drills

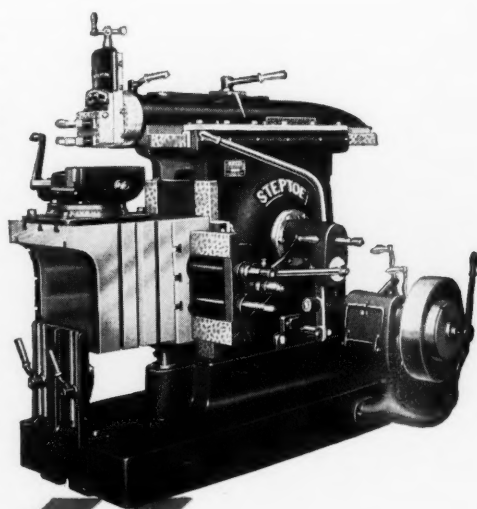


Drive Applied at Lower  
End of Spindle.

A husky tool—available in three models for heavy, standard and light work—all featuring the Low Hung Drive, which saves power by applying it directly to the work spindle. Chatterless and vibrationless at the heaviest feeds and speeds—profitable, productive and accurate on all work within a wide range. A dependable, modern machine, the details of which will interest you. Send for a Catalog.

### Stephoe Shapers

The Timken Bearings with which the Steptoe is equipped throughout are practically wearless. After years of service a simple adjustment of parts restores the bearings to their original efficiency—the machine is as good as new. Chrome Nickel Gears of Alloy Steel are also standard equipment — always smooth and silent, even though speed changes are made while the machine is in motion. Get the new Steptoe Catalog.



**WESTERN MACHINE TOOL WORKS**  
Holland, Mich., U. S. A.

# THOMPSON

## HACK SAWS

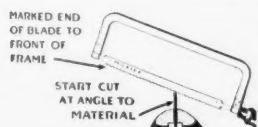
### How to Cut Sheet Steel and other thin materials

USE a Thompson Mil Flex WAVY SET blade with 32 teeth to the inch. It is designed especially for cutting materials up to 1/16 inch thick.

The teeth are set in waves that extend deep into the stock rather than set at the base of each tooth so that it is supported by the entire back. The special tungsten alloy steel gives to the teeth great toughness and helps to increase the cutting efficiency and long life.

Let's say you're cutting sheet steel in a vise. Put a WAVY SET in the frame with the teeth pointing forward. The best mechanics often get a saw in a frame backwards. Such a mistake can't occur with our blade, for every Thompson hack saw blade has its name stamped near the end that goes to the front of the frame. That's your guide. Use it!

Tighten the blade until it is well strained. WAVY SET, having a soft back, is



practically unbreakable. If it bends, straighten it and go ahead.

Always start a cut at an angle, using the full length, or as much of the blade as you can, to engage as many teeth as possible. This opens the cut quicker, prevents a few teeth from doing all the work and lengthens the life of the blade. Don't place the saw straight with the metal and fiddle back and forth on the same few teeth till the cut opens. No blade can stand such abuse.

Bear down with both hands and push forward. As the right hand comes to the job, slack off pressure and lift the saw lightly back for another cut. Sawing on the return strokes cuts no metal; the teeth are pointing forward and you simply file them off.

The harder the metal the slower the speed, to avoid friction and heat which ruin the blade. With a 32-tooth WAVY SET, 30 strokes to the minute is right.

Pick the right Thompson blade for the job... point teeth forward... start cut at an angle... don't saw on the back stroke... and Thompson Hack Saws will open your eyes with their quick, easy cutting and long service life.

THE HENRY G. THOMPSON & SON CO.

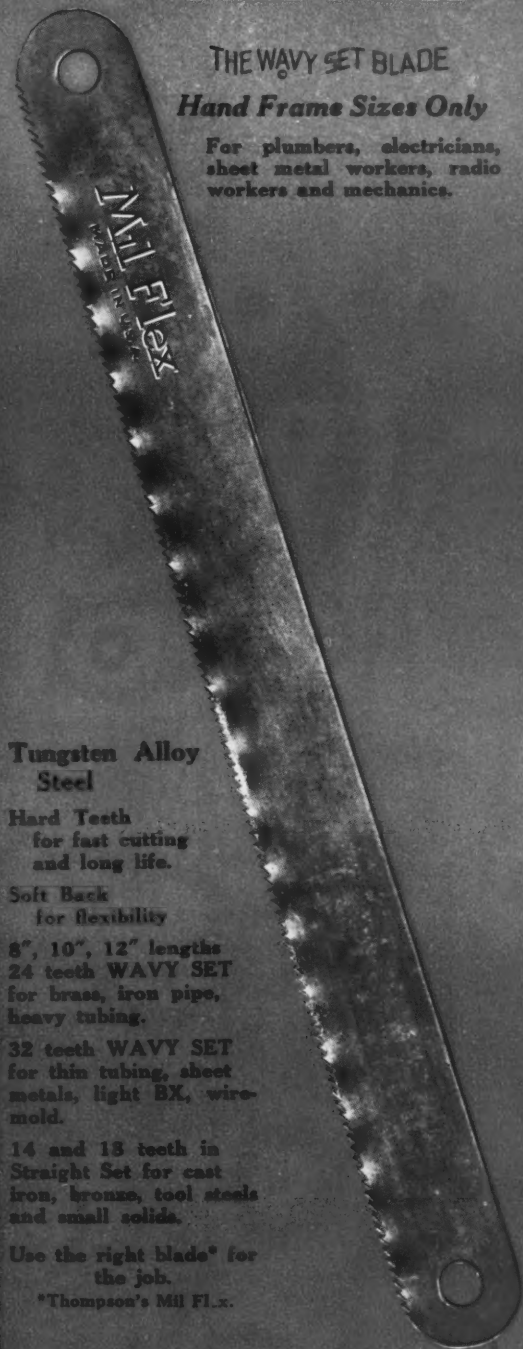
*Established 1876, Incorporated 1898.*

New Haven, Conn., U. S. A.

## Mil Flex

THE WAVY SET BLADE  
Hand Frame Sizes Only

For plumbers, electricians, sheet metal workers, radio workers and mechanics.



**Tungsten Alloy Steel**

**Hard Teeth**  
for fast cutting and long life.

**Soft Back**  
for flexibility

8", 10", 12" lengths  
24 teeth WAVY SET  
for brass, iron pipe, heavy tubing.

32 teeth WAVY SET  
for thin tubing, sheet metals, light BX, wire-mold.

14 and 18 teeth in  
Straight Set for cast iron, bronze, tool steels and small solids.

Use the right blade\* for the job.

\*Thompson's Mil Flex.



# ROCKFORD

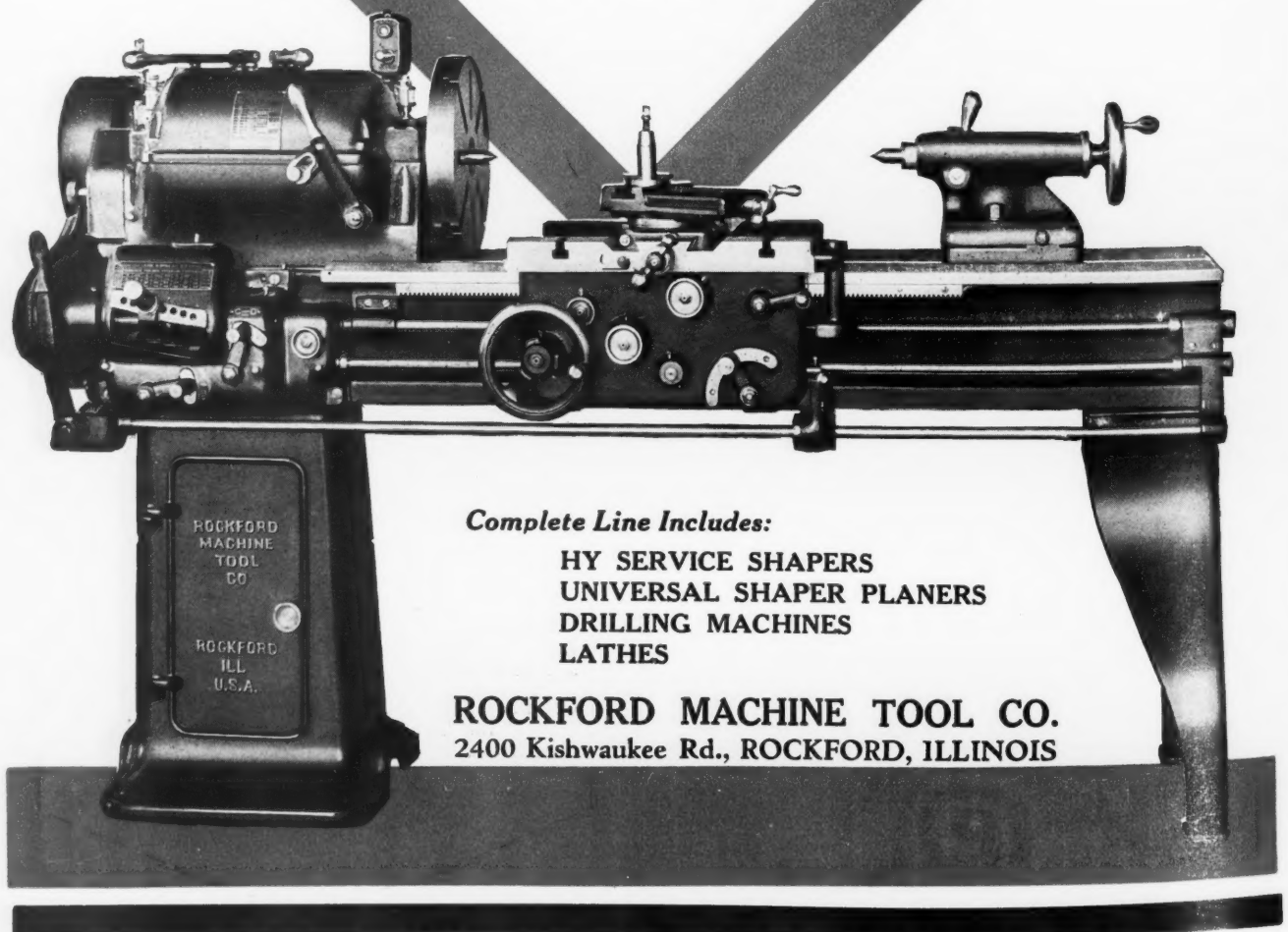
## Economy Lathes

**Low Cost Production on a Wide Range of Work**

Too much lathe for the work in hand loads the job with a heavy burden right at the start—it is hard to come out ahead under such conditions.

Rockford Economy Lathes have ample power, capacity and weight to handle the general run of manufacturing work—yet are small, compact, easily operated, fast. They occupy little space, use no more power than necessary and conserve the operator's time. As they are also extremely accurate and completely equipped they are entirely satisfactory in the tool room or for general repair work—widely useful and consistently economical.

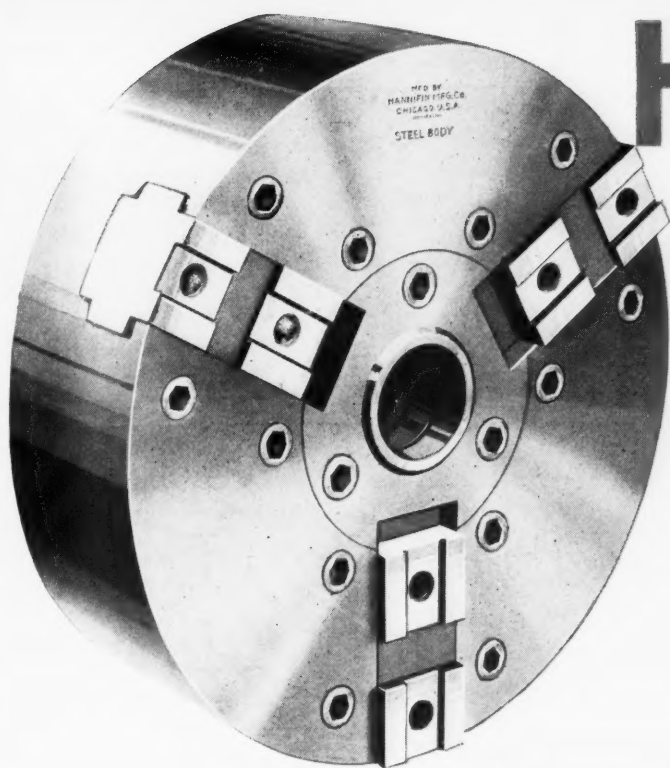
Made with Geared Head as illustrated in 12", 14" and 16" sizes, also with Cone Pulley Head in 12" and 14" sizes, and for ceiling countershaft.



***Complete Line Includes:***

**HY SERVICE SHAPERS  
UNIVERSAL SHAPER PLANERS  
DRILLING MACHINES  
LATHES**

**ROCKFORD MACHINE TOOL CO.  
2400 Kishwaukee Rd., ROCKFORD, ILLINOIS**



# HANNIFIN

## AIR-OPERATED 3-JAW HEAVY-DUTY UNIVERSAL CHUCK—MODEL B



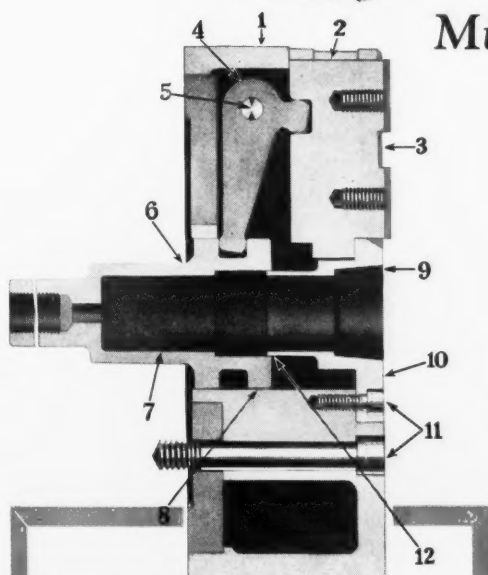
### Minimum Working Parts—Longer Lived

This improved air-operated Hannifin Chuck is made to a design that guarantees precise machining, absolute accuracy, and interchangeability. Not only is it built with an absolute minimum of working parts, but the body is constructed of one-piece electric steel, giving unusual strength and lightest possible practical weight. There is less strain and wear on the lathe spindle. A single set of grooves replaces the old style multiple grooves—another important improvement which assures even wear and proper load distribution—resulting in the chuck retaining its accurate fit indefinitely.

*Catalog describing this and other Hannifin Products sent on request.*

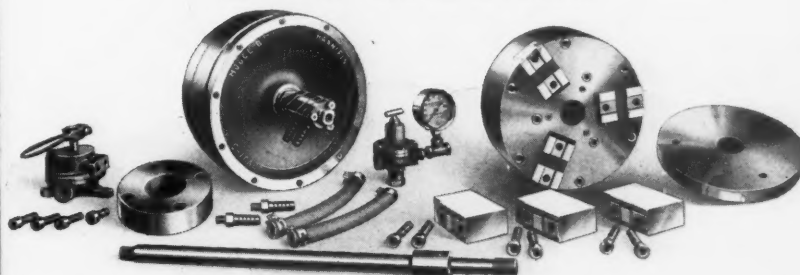
### Hannifin Products—

Standard Air Operated Chucks  
Special Air Operated Chucking Devices  
Air Operated Clamping Devices  
Air Operated Expanding Mandrels  
Air Operated Presses  
Air Operated Jigs and Fixtures  
Rotating Double-Acting Air Cylinders  
Stationary Double-Acting Air Cylinders  
Air Operated Vises  
Air Control Valves for all Purposes



### Hannifin Model B Heavy-Duty Three-Jaw Universal Chuck Has Minimum Number of Working Parts

- 1 BODY—one-piece electric steel casting
- 2 SINGLE HEAVY-DUTY SLOT.
- 3 MASTER JAWS—carbonized, hardened and ground.
- 4 JAW OPERATING LEVERS—one-piece extra heavy chrome nickel forging, heat treated, hardened and ground.
- 5 PIN—chrome nickel, heat treated, hardened and ground.
- 6 DRAW SLEEVE—one-piece chrome nickel, heat treated, hardened and ground.
- 7 DRAW SLEEVE—bored to accommodate boring bar pilots.
- 8 DRAW SLEEVE—ground slide fit in chuck body.
- 9 PILOT BUSHING—mounted in taper bore of pilot plate assures rigidity and accuracy.
- 10 HARDENED AND GROUND PILOT PLATE—mounted on the face of chuck reinforces chuck body.
- 11—HOLLOW HEAD SCREWS—heat-treated nickel steel.
- 12 ACCURATELY GROUND FIT of pilot plate and draw sleeve makes chuck dust-proof.

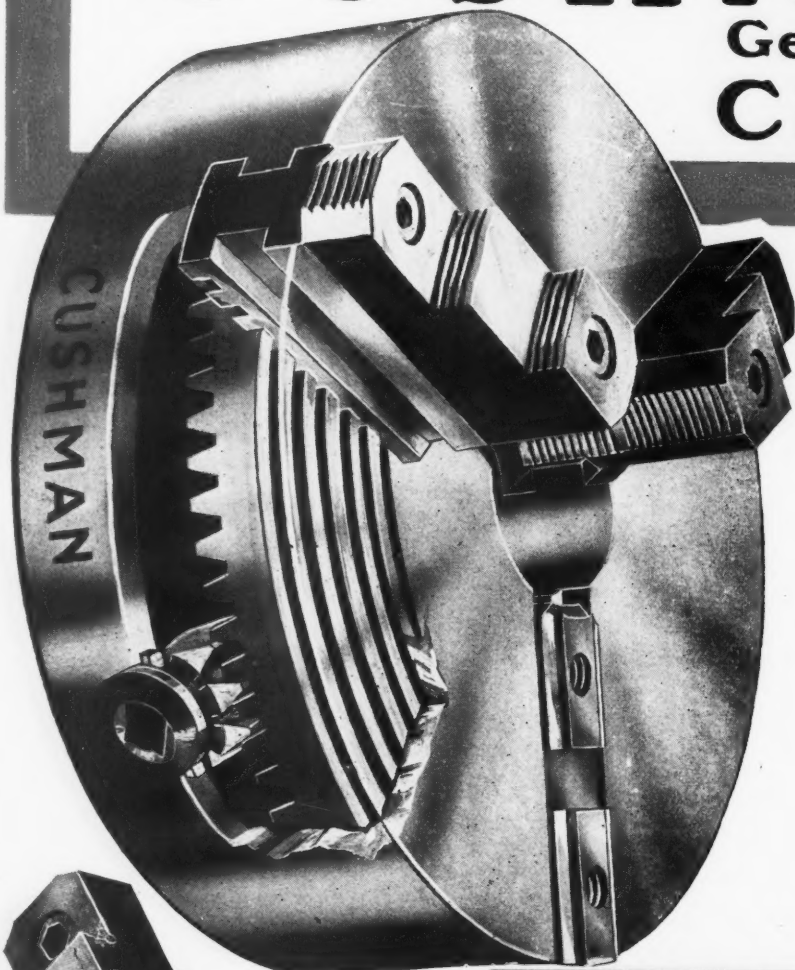


A Complete Air Chuck Equipment—Model B Chuck, Model B Air Cylinder, Control Valve, Pressure Regulating Valve, Adapter Plates, False Jaws and Draw Rod.

**HANNIFIN MANUFACTURING CO.**  
6216-31 S. Kolmar Avenue Chicago, Ill.

# CUSHMAN

## Geared Scroll CHUCKS

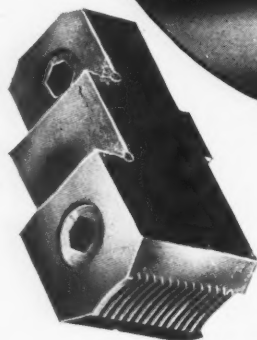


*They Last  
Longer*

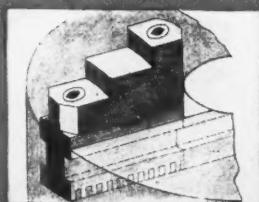
Cushman Chucks are phenomenally long lived because designed to avoid common weaknesses. All parts are accurately machined to close limits, dimensioned for a large overload factor, hardened at wear points. Many special features, found only in Cushman Chucks, add to convenience and precision.

Carried in stock in two models and many sizes. Model 34 has two sets of solid jaws for inside and outside holding—Model 36 has two-piece reversible jaws.

*Bulletin 84 describes these chucks in detail.  
Send for it and a copy of our Catalog.*



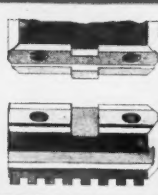
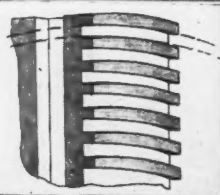
At right: The jaws of Cushman Chucks bear over their entire length, reducing greatly the common tendency to heel or bell-mouth.



**"CUSHMAN"  
CHUCKS  
1862**

At right: The teeth on the under side of jaws are formed to engage the scroll, bearing surface is thus increased and life lengthened.

Below: Ample bearing for the scroll is provided on hub of chuck to absorb strains, and fitting is done with extreme care.

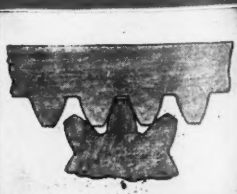


At left: No. 36 Chucks have two-piece jaws with reversible tops. This arrangement saves much time in changing.

Below: The coarse pitch of the pinion and scroll gear teeth assures strength and long wear.



**The Cushman Chuck Co.**  
Hartford, Conn.





# HOLE GRINDING

**B**EARING races, gears and cylinders were principally the work acknowledged as belonging to internal grinding only a few years back. Today, speed, change of design, harder materials, quietness, longer life and a score of other reasons have made grinding a necessity in practically every line of business.

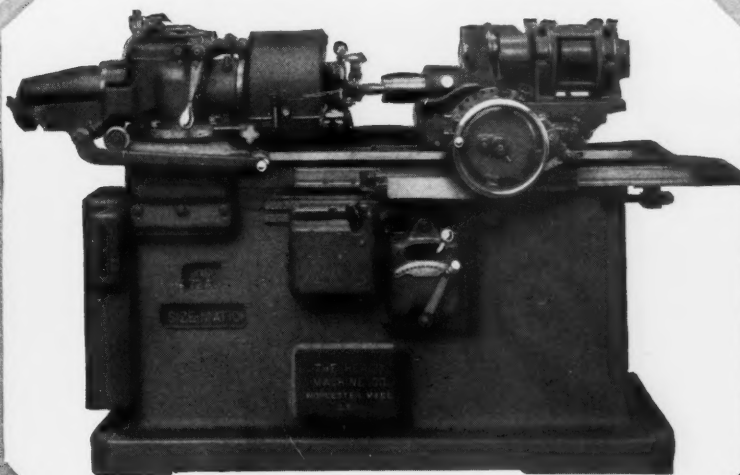
Heald has met this demand by not only being able to finish any hole that it is possible to grind, but in most cases doing it **AUTOMATICALLY**.

Every day, new internal grinding jobs are presented to our Service Engineering Department for solution and almost invariably the data supplied the customer invites the sale of a Heald. Why—

**Because He Cannot Afford Not To Buy It.**

Read that again—then start some of your internal jobs towards Worcester today.

**Only a HEALD Is AUTOMATIC**



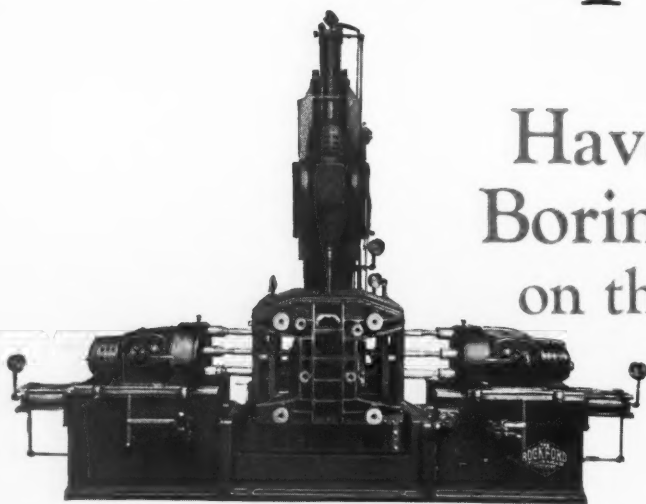
## THE HEALD MACHINE CO.

**WORCESTER MASS., U.S.A.**

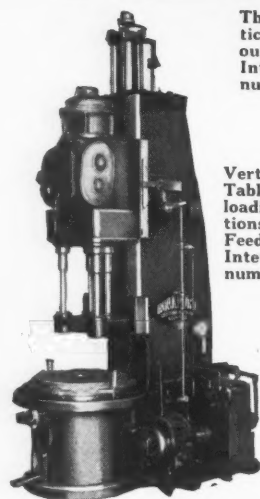
*Has held the confidence of the trade for over 100 years*

# To Be Specific —

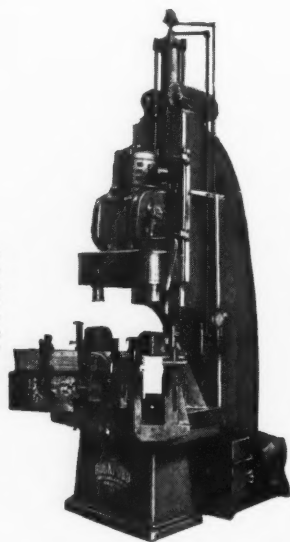
Have You Drilling or Boring Production Jobs on these or similar Parts?



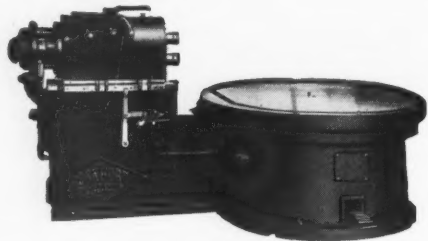
Three-Way Combination Horizontal and Vertical machine, all Heads feeding simultaneously. Fixture shown mounted in place. Interchangeable Spindle Units with any number of Spindles.



Vertical type machine, with Indexing Table for eliminating Loading and Unloading Time or for progressive operations with required number of stations. Feed is Hand or Automatically Controlled. Interchangeable Spindle Units with any number of Spindles.



Vertical type machine, with Stationary Table. Fixture mounted in place. Feed is Hand or Automatically Controlled. Interchangeable Spindle Units with any number of Spindles.



Single-End Machine. Indexing Table for eliminating Loading and Unloading time. Feed is Hand or Automatically Controlled. Interchangeable Spindle Units with any number of Spindles.

Transmission Cases

Cylinder Blocks

Crankcases

Pistons

Steering-Gear-Housings

Differential Carriers

Connecting Rods

Crankshafts

Universal Joints

Axle Housings

Wheel Hubs

Steering Knuckles

Clutch Centers

Pipe Flanges

Car Wheels

Pump Cylinders



For Greater Production—Write:

Rockford Drilling Machine Co.  
Rockford, Illinois

## ROCKFORD

### Oilgear Feed Drilling and Boring Machines

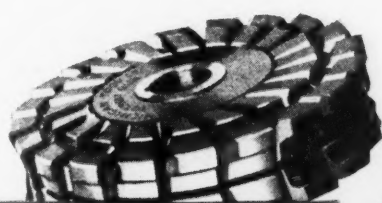
# MICHIGAN



## *Formed Cutters and Hobs* *Cost Reducing Production Tools*

Michigan Special Formed Cutters *correctly designed* frequently save several operations in machining intricate form parts; they have reduced cutting time as much as 300% on some work and cut costs as much as 250%.

Michigan equipment, facilities, experience guarantee tool service as well as modern design—they stand up to the toughest job, meet the standards of the most up-to-date machines.



### **Products of the Michigan Tool Co.**

Hobs (Ground and Un-ground)

Gear Shaper Cutters

Spline Shaft Hobs

Single Purpose (Involute) Gear Cutters

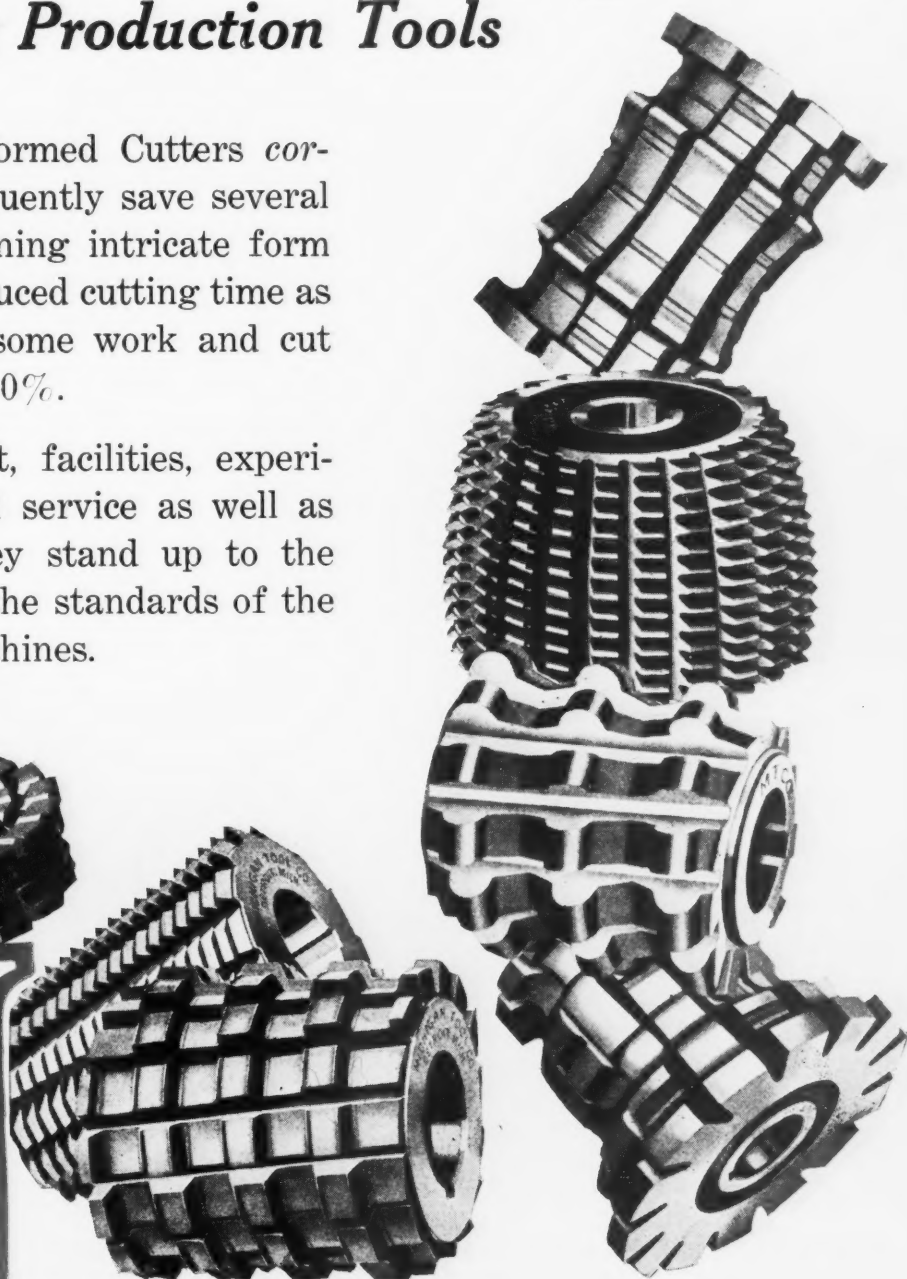
Milling Cutters (All Types)

Ground Thread Taps

Thread Milling Hobs

Formed Tools for Screw Machine Work

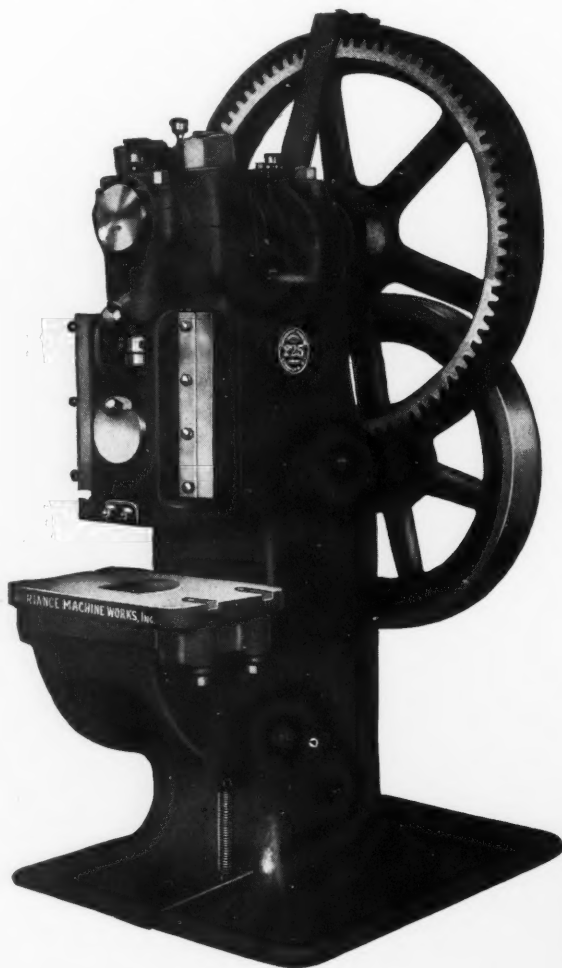
*Tool Engineering Service  
and Complete Catalog  
on request.*



**MICHIGAN TOOL COMPANY**  
Detroit, Michigan, U. S. A.



# "ADRIANCE"



*Pacific Coast Representatives, C. F. Bulotti  
Machinery Co., 829 Folsom Street,  
San Francisco, Cal.*

*Western Machinery Exchange, Santa Fe Ave.  
at 9th St., Los Angeles, Cal.*

*Buck and Hickman Ltd., 2 Whitechapel Road,  
London, sole agents for Great Britain.*

*The Verner Steel Products Co., 1928 Monterey  
Avenue, Chicago, Ill.*

**T**HE symmetrical design and sturdy construction that characterize the "Adriance" line of power punching presses assure long life for press and tools and the operation of the press with speed, precision and accuracy. We furnish special "Adriance" roll, dial and chute feeds for these presses making complete automatic units that will place your sheet-metal working plant on an economical production basis. Mail attached coupon for further particulars.



ADRIANCE MACHINE WORKS, INCORPORATED

78 RICHARDS STREET, BROOKLYN, N. Y.

*Please send Bulletin No. 11 with information regarding power punching presses.*

Name ..... City ..... State .....

# The Standard of Accuracy—

When a question of accuracy arises—when the last check-up is made—the Slocomb Micrometer gives the final decision. Reads easily to *half-thousandths* or less—and the Tool Steel Spindle, hardened, ground and fitted with consummate precision, carries constant conviction that the Slocomb is unfailingly right.

Used at every step for routine gaging and checking, it eliminates a cumulative error which is sure to result in costly remachining and rejections.

# SLOCOMB



**J. T. SLOCOMB COMPANY**  
PROVIDENCE, R. I.

MACHINERY, August, 1928—67

# Hanson Process Taps

## *For Precision Threading*



Hanson-Whitney "Hanson Process" Taps offer the manufacturer a complete line of taps for performing precision threading operations on a production basis.

The design of each style and size is based upon exhaustive research and years of practical shop experience. Steels are especially selected and heat treated with rigid uniformity. And as a final step Hanson Process Taps are finished *after* hardening, a method which eliminates the inevitable inaccuracies caused by changes during hardening.

Hanson Process Taps cut threads of unmatched uniformity and precision with a smoothness, rapidity and freedom from tap breakage which greatly reduce tapping expense.

Styles and sizes cover every requirement. Catalog on request.



## The Hanson-Whitney Machine Co.

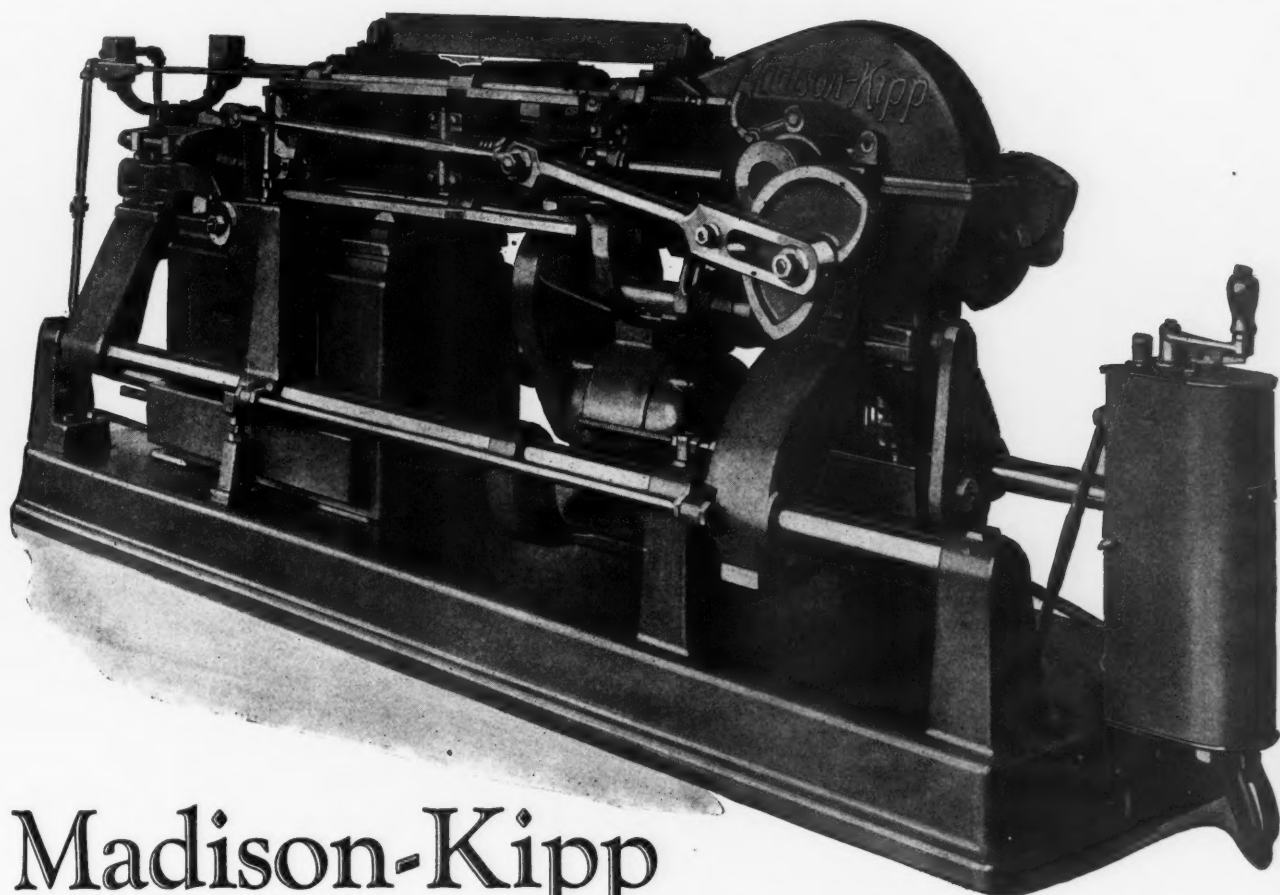
Hartford, Conn.

DOMESTIC REPRESENTATIVES:—New York, N. Y., L. C. Biglow & Co., Inc.; Syracuse, N. Y., George McPherson; Philadelphia, Pa., D. J. Normyle; Pittsburgh, Pa., William K. Stamets; Cleveland, O., William K. Stamets; Cincinnati, O., Seifreut-Elstad Mch. Co.; Dayton, O., Seifreut-Elstad Mch. Co.; Detroit, Mich., A. G. Bruce; San Francisco, Calif., A. H. Coates Co.; Chicago, Ill., E. H. Huntington; Toronto, Montreal and Vancouver, Arthur Jackson Mch. Tool Co.

FOREIGN REPRESENTATIVES:—London, England, Leo C. Steinle; Rotterdam, Holland, R. S. Stokvis & Zonen, Ltd.; Stockholm, Sweden, Rylander & Asplund; Maskinforsalning A-B; Paris, France, Fenwick Freres & Co.; Turin, Italy, Fenwick Freres & Co.; Brussels, Belgium, Fenwick Freres & Co.; Barcelona, Spain, Fenwick Freres & Co.; Rio de Janeiro, Brazil, Fenwick Freres & Co.; Zurich, Switzerland, Fenwick Freres & Co.; Tokyo, Japan, Andrews & George Co.; Sydney, Australia, H. P. Gregory & Co., Ltd.



# Completely Automatic



## Madison-Kipp Die Casting Machine

Operation of the Madison-Kipp Die Casting Machine is completely automatic with desirable safety features covering movement of the metal, movement of the die, and movement of the cores.

All the operator has to do is to supply new metal, clean and oil the die with air hose, and watch the casting. As

delivered to you with dies produced by our die service, pulling of cores is all automatic, and cores are pulled in proper sequence, regardless of their number.

The Madison-Kipp is a modern production tool designed for factory use. If you are a user of die castings, let us send you complete information on the Madison-Kipp Die Casting Machine.

**MACHINES DIES SERVICE**  
*Madison-Kipp*  
**CORPORATION**  
*Madison* *Wisconsin, U.S.A.*

# VERSATILITY

NAME your operation; fine threading? coarse threading? turning?—this "Agrippa" Threading Tool, with Lockable-Spring Head, will handle them all.

The cutter-hole is broached at 30° while the cutter-bit is ground at 30°, providing a 60° cutter, readily set for either fine or coarse threads.

Another exclusive feature is the offset shank, permitting the tool to be set ahead of the lathe carriage, yet keeping the cutter in line to spring clear of the work.

Williams' "Agrippa" Tool Holders embody many advantages in design and construction. Ask for literature describing the complete line.



J. H. WILLIAMS & CO.,

"The Drop-Forging People"

New York

BUFFALO

Chicago

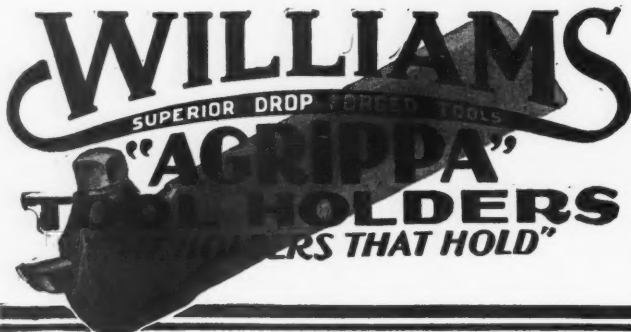


## Dependable Forgings

Williams' Superior Drop-Forgings come to you with our unqualified guarantee. Entirely dependable, they will meet your specifications to the last jot and tittle.

We operate our own chemical and physical laboratories and are fully equipped with modern facilities for all forms of heat-treating. All furnaces, electric or oil-fired, pyrometer controlled.

Let us quote you on accurate, dependable, clean (sand blasted) forgings—guaranteed.



# BALANCE

FOR better balance on your lathes, try better lathe dogs—dogs that assure reliable turning, freedom from expensive breakdowns and all-around better jobs.

Williams' "Vulcan" Dogs are sturdy, rigid, better-balanced. Drop-forged from tough carbon steel, they provide stiffness and strength without excessive bulk. The Screws are of special steel, hardened and tempered.

They add balance to your lathe, safety to its operation, volume to its production. Send for "Vulcan" Lathe Dog literature today.



"VULCAN"  
Heavy Service  
Safety  
Lathe Dog

J. H. WILLIAMS & CO.,

"The Drop-Forging People"

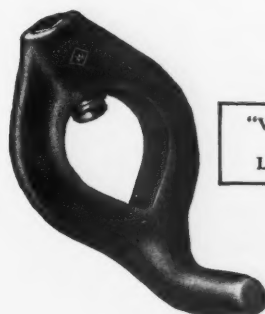
New York

BUFFALO

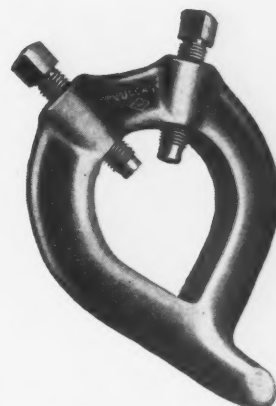
Chicago



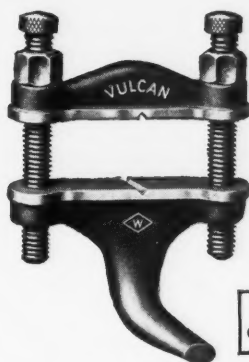
"VULCAN"  
Milling Machine  
Dog with Flat Tail



"VULCAN"  
Safety  
Lathe Dog



"VULCAN"  
Heavy Service  
Lathe Dog with  
Square Head  
Screws



"VULCAN"  
Clamp Lathe Dog



"VULCAN"  
Lathe Dog with  
Square Head  
Screw

Williams' "Vulcan" Clamp Dogs are drop-forged from a strong, tough grade of specially selected steel and heat-treated to further increase their strength and stiffness. The liability of springing is reduced to the minimum. Screws are hardened and tempered. Nuts are case-hardened.

**WILLIAMS**  
SUPERIOR DROP-FORGED TOOLS  
**"VULCAN"**  
**LATHE DOGS**





# —STAR—

## Engine

## Lathes

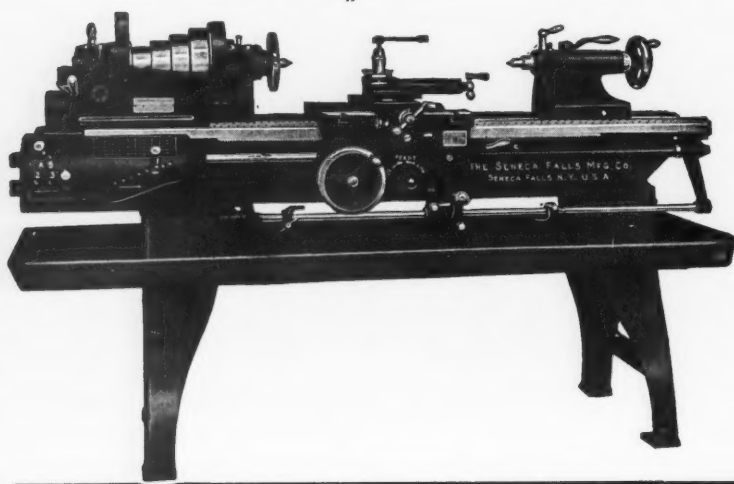


### *The Unchallenged Testimony of Repeat Orders—*

The testimony of a repeat order—the obviousness of its implication—requires neither explanation nor embellishment. Neither letter nor spoken word could more clearly say, "This machine has served us well. We believe it to be the best on the market for our needs."

Here in the plant of a nationally known maker of quality drills and grinders are six Star Lathes. The original installation was three; the remainder were added at intervals over a period of many years. On a wide range of work—held to the closest limits of accuracy despite the exigencies of a high production pace—they have established an unequalled "low" for turning costs and earned the standardization of this organization on all work within their range.

Catalogs of the "Star" Lathe on request. Also Manufacturers of the famous *Swing* line.



### SENECA FALLS MACHINE COMPANY

1 SENECA FALLS, NEW YORK

*The Swing People*

District Sales Manager for Michigan and Ohio: W. H. Nettle, 236 Richton Ave., Highland Park, Detroit, Mich.

District Sales Manager for Wisconsin, Illinois and Indiana: John A. Camm, 662 48th Street, Milwaukee, Wis.

Pacific Coast Representative: Louis G. Henes, San Francisco and Los Angeles.

European Office: 42 Rue le Peletier, Paris, 9e, France, in charge of George E. Fogarty, European Sales Manager.



## NEW BRITAIN AUTOMATIC CHUCKING MACHINE

### SIZE 23A

A husky, fast, four-spindle Automatic Chucking Machine with AIR CHUCKS.

Tool rotating type.

High speed production obtained through reciprocation of light parts and individual feed of spindles.

Turret indexes, but does not reciprocate. Air chucks incorporated in turret enable operator to keep up with rapid index.

Indexes up to 1250 per hour. Total idle time for spindle draw-back, jump and turret index less than 1½ seconds. Seven inch chuck capacity.

Positive lead screw threading. Individual spindle speeds up to 1200 R.P.M. Automatic FORCE FEED lubrication throughout. Weight—7,000 lbs.

THE NEW BRITAIN MACHINE CO.

New Britain, Conn.

# Super- Production



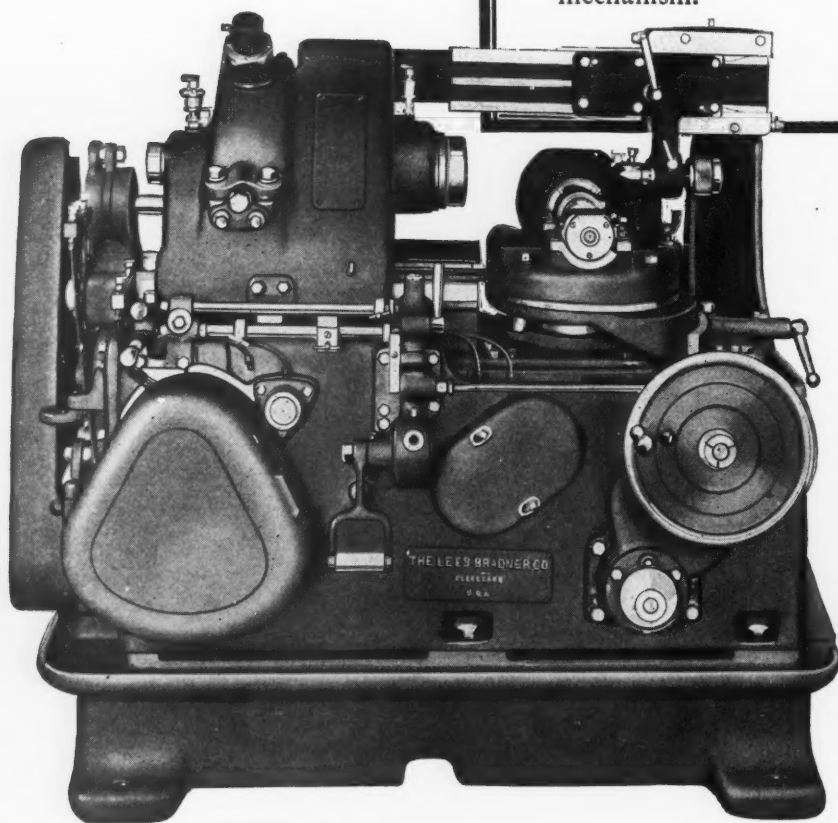
# Accuracy plus The **LEES-**

## Production Gear Hobber

This machine was designed for accurate, rapid production of automobile transmission gears, spline shafts and splines on propeller and axle shafts.

Accessibility is one of its features, it being very easy to handle work into and out of the machine.

The Lees-Bradner patented compound index provides a wide range of work spindle speeds, permits indexing small or large number of teeth without undue strain on the indexing mechanism.



### *Lees-Bradner Patented New Method of Gearing for Helical Gear Set-Ups*

This patented method eliminates complicated calculations. It is only necessary to divide the lead by the feed selected for the job and the gears are picked from charts provided with the machine.

Gear Grinders  
Gear Hobbers  
Gear Testers

## The Lees-Bradner Co.,



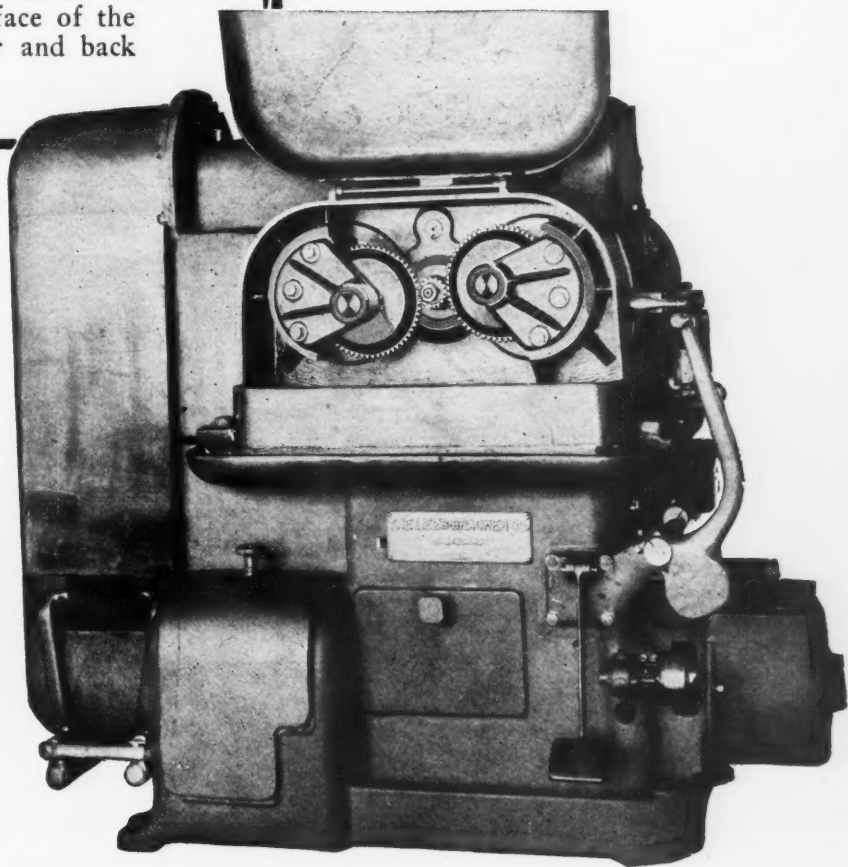
# Productivity **BRADNER**

## Gear Finishing Generator

An entirely new and original method for correcting errors in tooth contour and spacing is offered in the Lees-Bradner Gear Finishing Generator.

The most amazing feature of this machine is its remarkable speed of production—a finished gear in less than a minute.

It is designed to handle spur gears singly or in clusters. In operation the work spindle has a reciprocating action which feeds the work forward and back across the face of the tool gears. One pass over and back completes the operation.



*Two Modern Machines  
which produce more work  
in less time, at lower cost*

In the No. 1 Gear Hobber and Gear Finishing Generator, Lees-Bradner offer an exceptionally profitable combination. Write for bulletins or send blue prints for estimates.

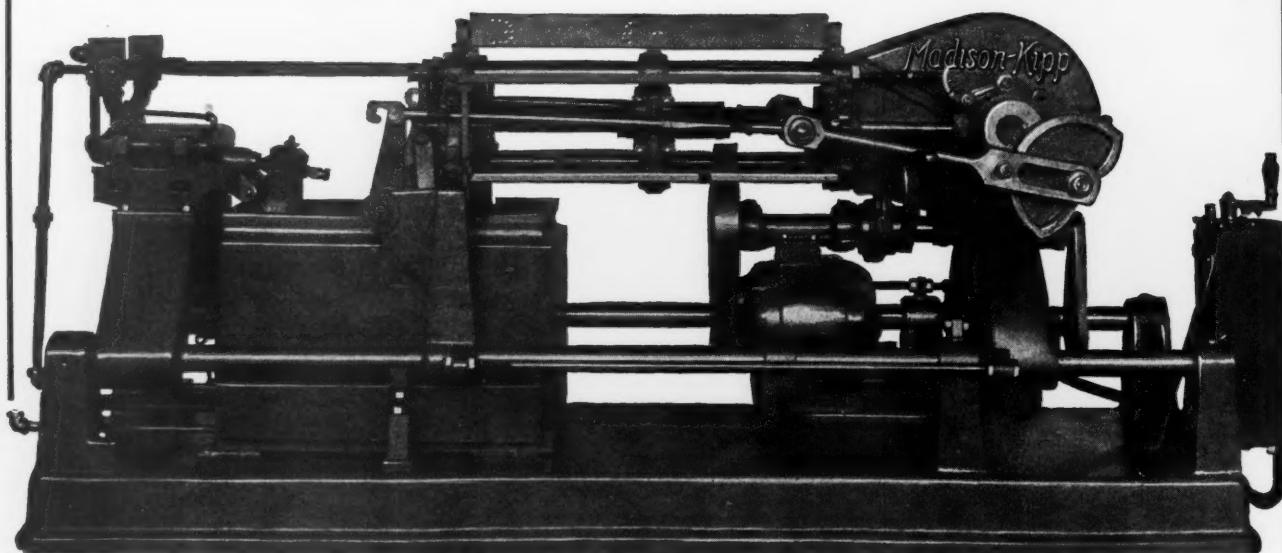
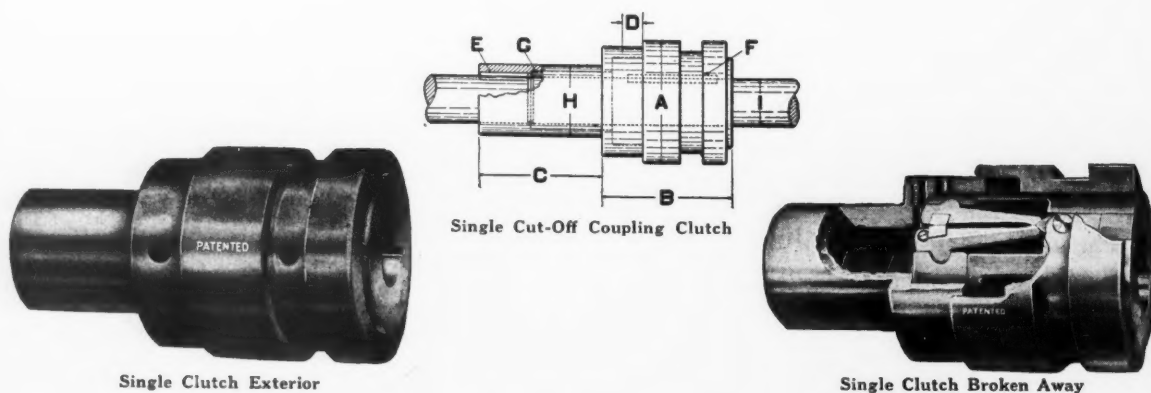
Cleveland, Ohio

Gear Finishing  
Generators  
Thread Millers

# THE JOHNSON FRICTION CLUTCH

as used on the

## Madison-Kipp Die Casting Machine



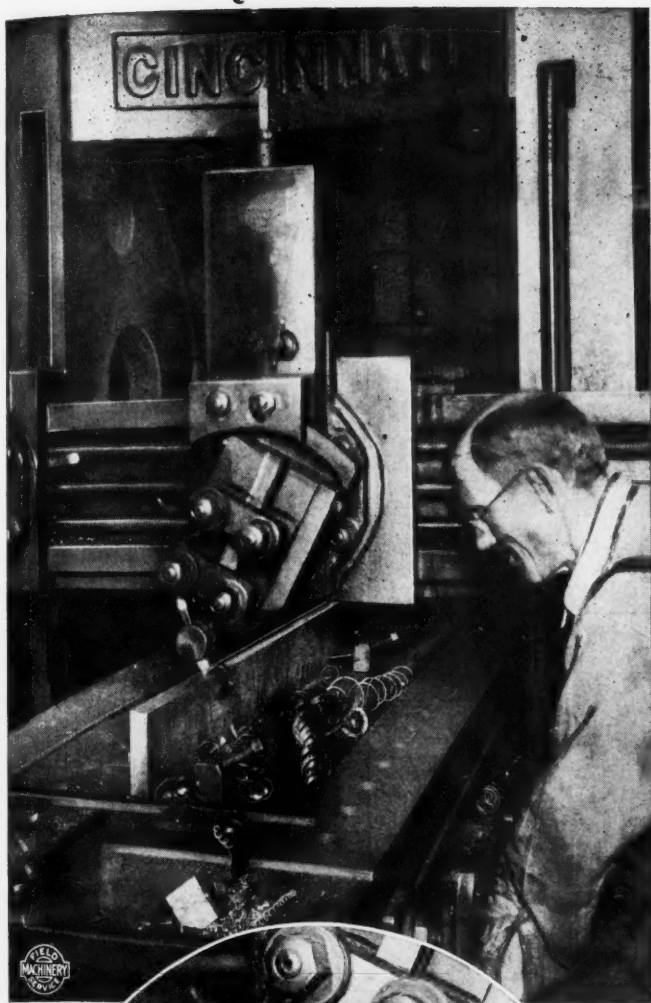
*Courtesy: The Madison-Kipp Corp., Madison, Wis.*

A No. 5 special single Johnson Friction Clutch, transmitting 2 horsepower at 600 R.P.M., is shown above in the cut, above and to the right of the driving motor, the clutch being a one-way cut-

off coupling, connecting this driving motor to the power receiving end of the machine. This clutch is operated by hand approximately 2000 times per day.

Write for Catalog "A"

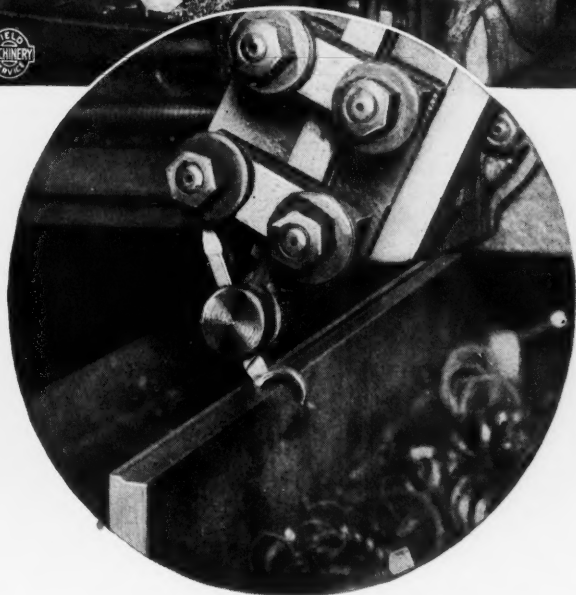
THE CARLYLE JOHNSON MACHINE CO. MANCHESTER-CONN



## Tough Going!

An Armstrong No. 42 Tool Holder is here shown holding a  $\frac{1}{2}$ " x  $\frac{3}{4}$ " high speed steel tool bit taking a long  $\frac{1}{4}$ " cut in razor steel, feed  $\frac{1}{16}$ "—a real test of a tool holder. A brake punch is being shaped out of a piece of steel 13' 6" long, 5" high and 1" thick.

The photograph was taken in the plant of the J. S. Thorn Co., Philadelphia, Pa., makers of sheet metal and cold rolled steel products for building construction. This company has been using various sizes and styles of Armstrong Tool Holders for ten years. Armstrong Tool Holders eliminate all forging, save 90% of tool steel and 70% grinding, and as this example proves—they give entire satisfaction in the heaviest service.



Let us send you the complete description of the Armstrong Tool Holder System and Armstrong Quality Tools.

### Tools that cut cutting costs



Straight Shank Turning Tool



Straight Shank Cut-off Tool



Knurling Tool



Planer and Shaper Tool



Boring Tool

For best results  
use Armstrong  
H. S. Cutter Bits

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

313 N. Francisco Ave.

Chicago, Ill.

# ARMSTRONG

TRADE MARK REG. IN U.S. PAT. OFFICE

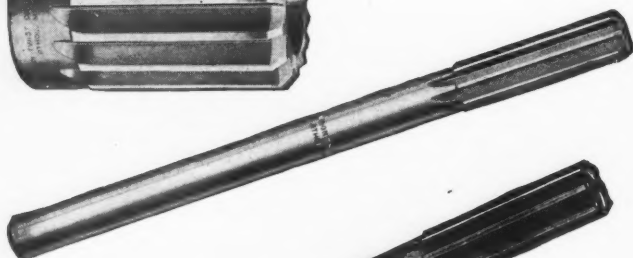
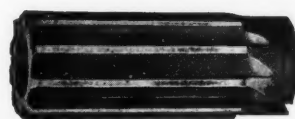
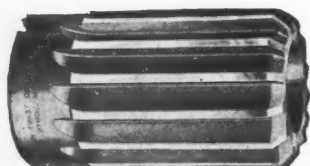


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# Union Twist Drill Company

Without question they are  
"Tools you buy again"

It's an established fact that *Union Reamers give real service.* Performance shows it, results verify it and the satisfaction of their users proves it.



## UNION Reamers

For All Purposes

UNION TWIST DRILL CO.  
ATHOL, MASS.

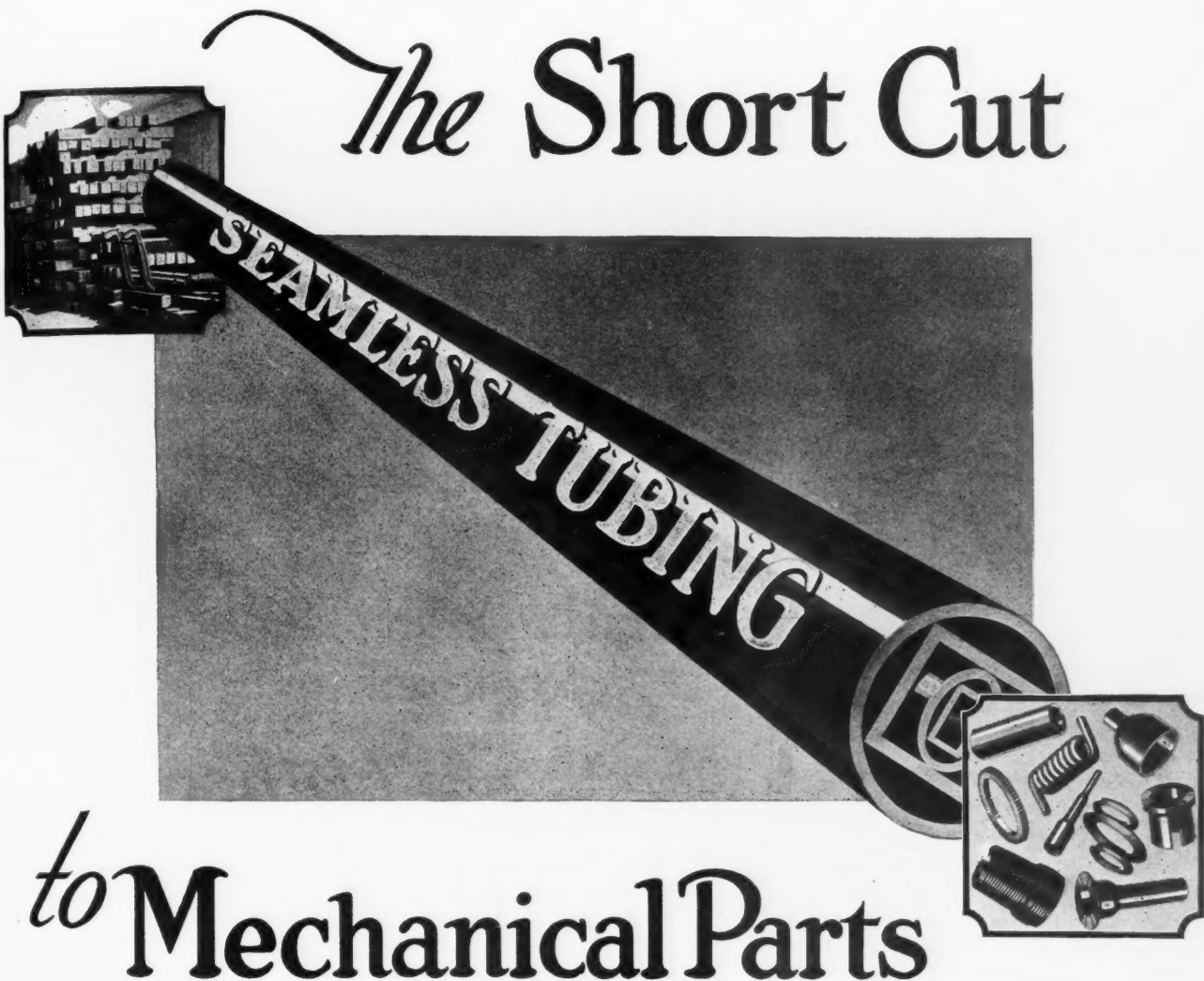
Chicago Store: 11 So. Clinton St.

New York Store: 62 Reade St.

Mansfield, Mass.

All Kinds of Cutters, Twist Drills, Reamers, Etc.  
AGENTS THROUGHOUT THE WORLD  
Derby Line, Vermont

Rock Island, Quebec



# *The Short Cut* to Mechanical Parts

IN this modern day and age, no matter what the industry or field of endeavor, the quickest and shortest route to efficient results is the main thing sought after. In the manufacture of machinery parts, especially is this advantage desirable, on account of the labor, tools and machine work required in the shaping up of the different commodities.

"NATIONAL-SHELBY" Seamless Tubing, in thousands of cases, is a short cut for manufacturers and machinists in the making of their product. You may find among the various shapes, sizes and wall-thicknesses of "NATIONAL-SHELBY" Tubing a material of just the right dimensions, grade of steel and anneal for your present or prospective requirements.

In many cases "NATIONAL-SHELBY" Tubing is used just as it comes from the mill, with possibly a light finishing cut or grinding, and wherever used in place of solid stock, machine work is reduced, tools and labor saved, and exceptional uniformity obtained in the finished product.

Ask for Bulletin No. 17. Among the production "short-cuts" it indicates you may find a suggestion of much value or a solution to some difficult problem.

NATIONAL TUBE COMPANY, PITTSBURGH, PA.

# "NATIONAL" SHELBY

# Man Power



*Chinese coolies unloading tea at Hankow.*

Man power is not expensive in the East—nor is time important. When—rarely—the prod of necessity urges too insistently, the job is speeded by using many men—a broad back and sturdy legs will do your bidding from sunrise to sunset for a few cents.

In the West things are not so simple. Man power bulks large in production costs. Competition is met successfully only when man power is expended with consummate economy.



*"Specialists in Horizontal Boring,  
Drilling and Milling"*

**GIDDINGS & LEWIS  
MACHINE TOOL CO.**

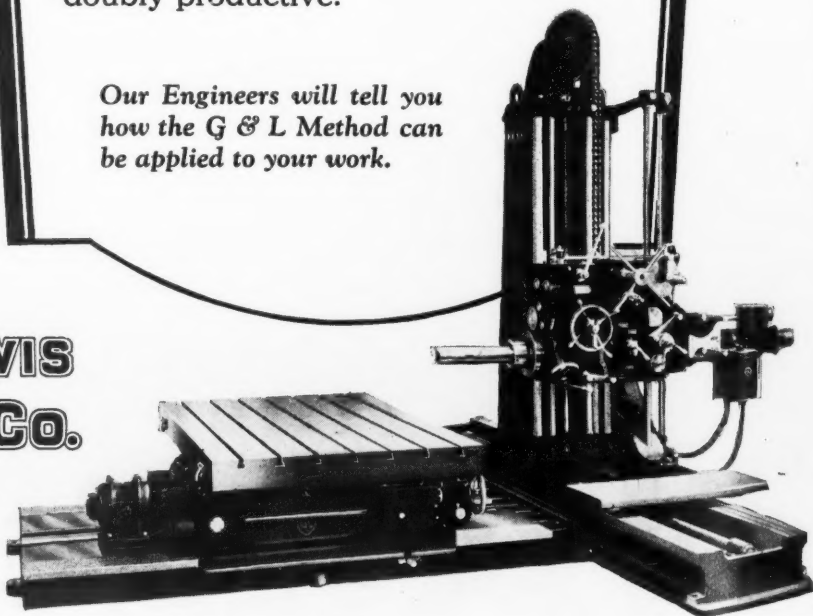
Founded 1859

Fond du Lac, Wisconsin

## Fewer Man-Hours Required by *The G & L Method*

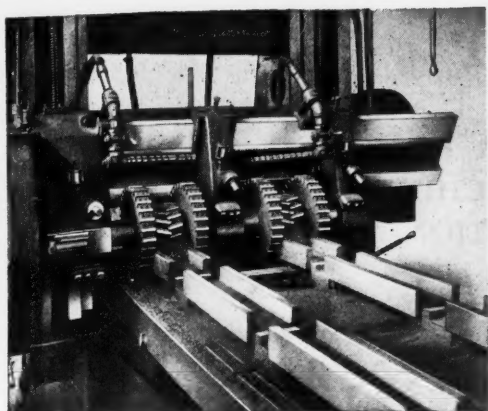
An advantage of the G & L Method, which results in important direct savings, is reduction in man-hours required for any given job. By the G & L Method, once a piece of work is set up, boring, drilling and milling operations are performed upon it without removal to another machine. One machine, one set-up, and a straight-to-the-mark convenience which makes man-power doubly productive.

*Our Engineers will tell you  
how the G & L Method can  
be applied to your work.*





# 42 pairs of shoes a day



THAT'S what four Production Tool Company cutters, with inserted Haynes Stellite blades, turn out to keep one of the largest railroads "shod."

These pedestal shoes and wedges are iron castings. The two outside surfaces are finished by two cutters 16" in diameter. The inside surfaces are milled by two smaller cutters 9" in diameter.  $\frac{1}{8}$ " stock is removed from each surface with a table feed of  $7\frac{1}{2}$ " and a cutter speed of 24 revolutions per minute. Twelve shoes are handled at once.

That is milling on a quantity production basis! Yet it is "just another job" for Haynes Stellite cutting tools.

In any up-to-date machine shop you now find Haynes Stellite being used on a multitude of jobs. It is used as a coating on cams, lugs, fixtures and many other wearing surfaces. A Stellite surface will outlast steel three to five times, and it is easy to produce in your own shop. Simply melt a rod of Haynes Stellite in the oxy-acetylene flame and deposit the metal on the heated steel surface.

We have a booklet, "Stellite Metal Parts," which tells how it is done. We shall be pleased to send it to you.

## HAYNES STELLITE COMPANY

*Unit of Union Carbide and Carbon Corporation*



### DISTRICT SALES OFFICES

CHICAGO—1949 Peoples Gas Bldg.	LOS ANGELES—1310 Santee Street
CLEVELAND—628 Keith Building	NEW YORK CITY—30 East 42d St.
DETROIT—4-240 Gen'l Motors Bldg.	SAN FRANCISCO—114 Sansome St.
HOUSTON—6119 Harrisburg Blvd.	TULSA—Exchange Nat. Bank Bldg.

*General Offices—Kokomo, Indiana*

*Stellite  
with*

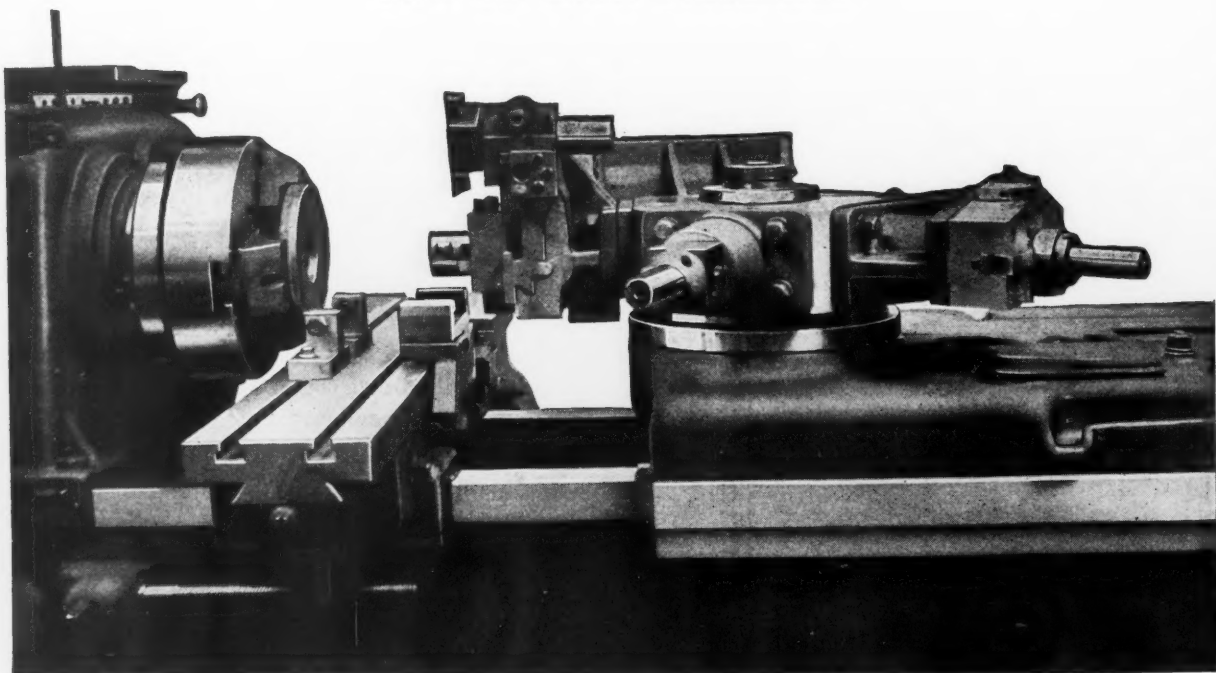
# HAYNES STELLITE

---

# 40

## Vibration Damper Flywheels per Hour

PRODUCED BY ONE OPERATOR HANDLING  
A BATTERY OF FOUR MACHINES  
TWO ON EACH OPERATION



### 5 D AUTOMATIC

The 5D POWER-FLEX AUTOMATIC set up for  
handling the first operation on damper flywheels.

*Our engineers will be glad to study your production prob-  
lems, and recommend equipment which will  
reduce your production costs*

**POTTER & JOHNSTON MACHINE COMPANY**  
PAWTUCKET, RHODE ISLAND, U. S. A.  
REPRESENTATIVES IN THE PRINCIPAL CITIES OF THE WORLD

---

# Take Another Vacation!

—right in your own office

Or if it's still to come, make it  
a better one

The good effects of a midsummer rest are soon dissipated if your return to the job brings you right smack up against the same old turning problems. Take another vacation—this time in your plant—with a *Lo-Swing* Model R Automatic instead of a golf-bag. You'll find it a lot easier to reduce your lathe costs than your stroke handicap—and a lot more profitable.

Actual check-ups on *Lo-Swing* performances in all types of shops reveal consistent net returns ranging from 62% to 150% on the investment. *Lo-Swings*, operating at 95% efficiency, are replacing entire batteries of lathes and handling every kind of turning work with greater speed, accuracy and economy.

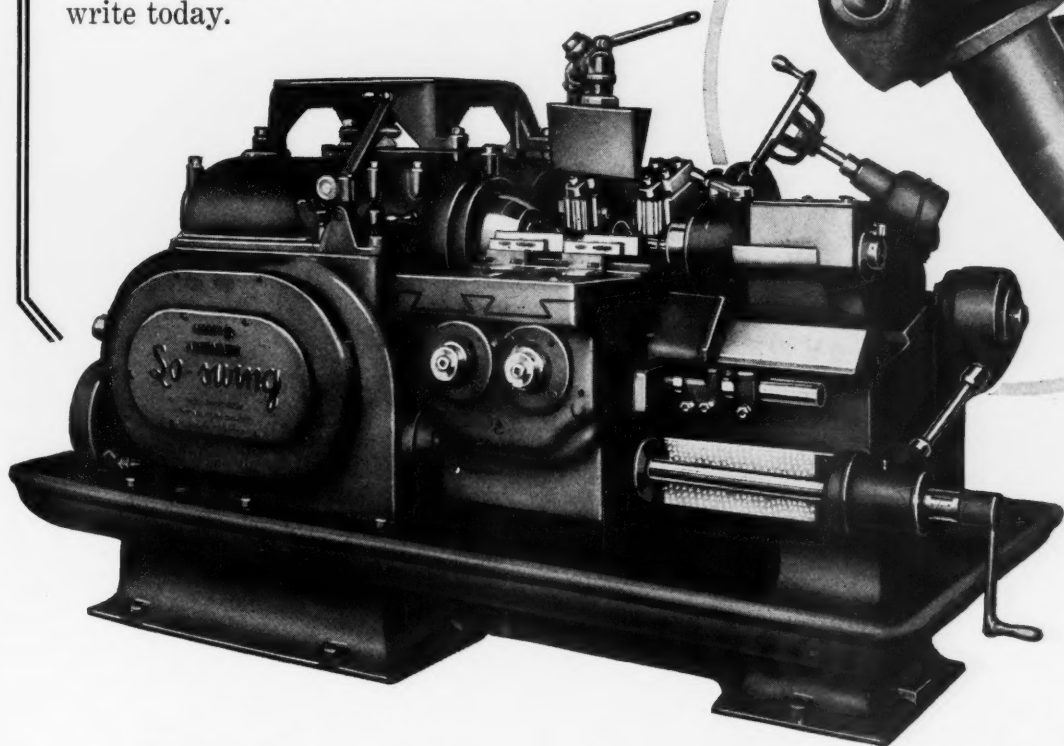
Talking it over with a *Lo-Swing* engineer entails no obligation. Get in touch with us—write today.

Two *Lo-Swings* Save \$6000  
a Year Here

The product is steering knuckles for 2, 3 and 5 ton trucks. The cuts are heavy, the work machined from rough forgings in one cut—formerly it required several, in addition to a straightening operation, now eliminated. One operator, not especially skilled, handles both machines producing a smoother surface than was formerly produced with a much lighter cut.

The savings total \$5,965.57 a year at full production—an annual return of 62% on the investment. The saving in labor alone amounts to \$3,832.95.

For the full story of the job write us for Survey No. SX-51-SM.



## SENECA FALLS MACHINE COMPANY

SENECA FALLS

The *Lo-Swing* People

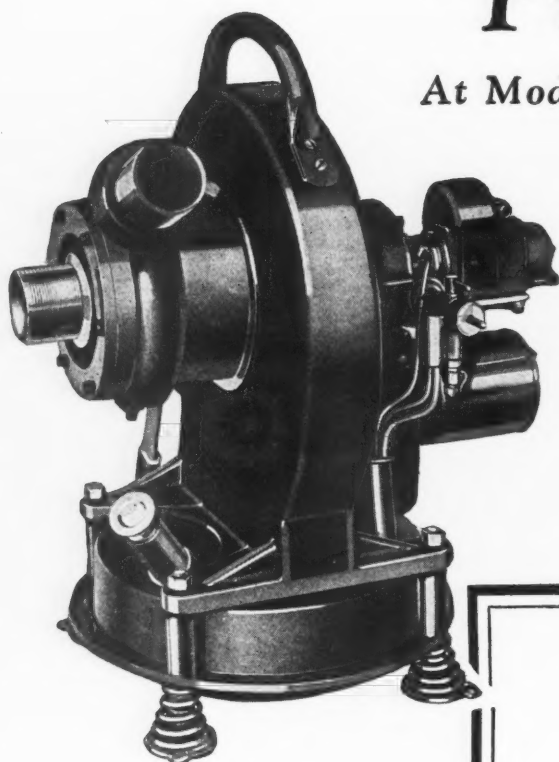
NEW YORK

District Sales Manager for Michigan and Ohio: W. H. Nettle, 236 Richton Ave., Highland Park, Detroit, Mich.  
District Sales Manager for Wisconsin, Illinois and Indiana: John A. Camm, 662 48th Street, Milwaukee, Wis.  
Pacific Coast Representative: Louis G. Henes, San Francisco and Los Angeles.  
European Office: 42 Rue le Peletier, Paris, 9e, France, in charge of George E. Fogarty, European Sales Manager.



# "Homelite" Proves That "Precision" Pays

*At Moderate, as Well as at Highest, Speeds*

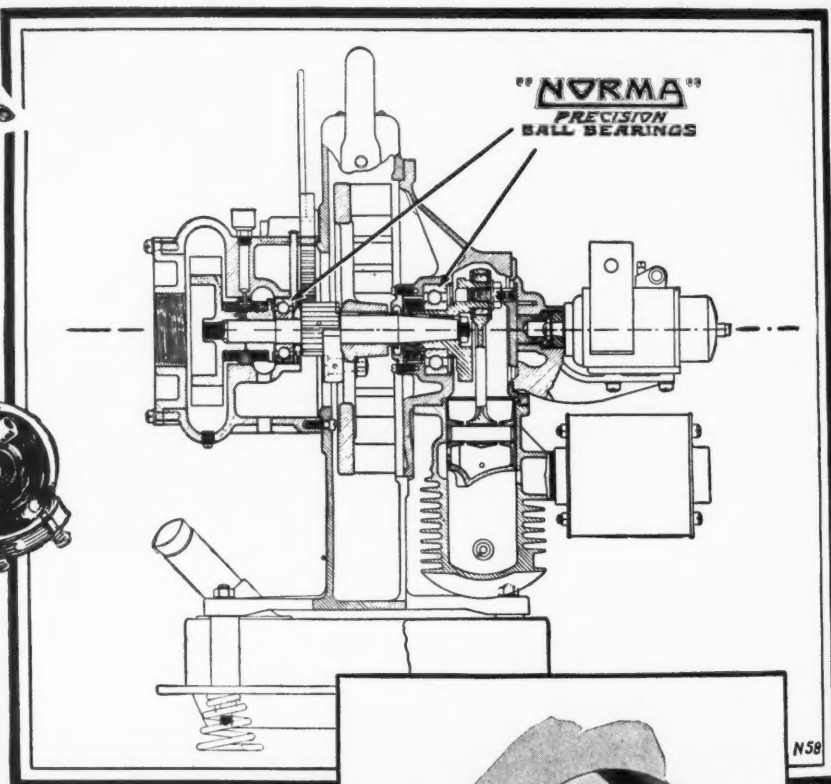


"HOMELITE" Portable Centrifugal Pumps (the Homelite Corporation, Port Chester, N.Y.) have a nation-wide reputation for economy, capacity and reliability. They use "NORMA" Precision Ball Bearings exclusively. And the performance of these bearings at 1800 R. P. M. proves that "PRECISION" is as worth-while at lower speeds as at the higher speeds up to 50,000 R. P. M. which "NORMA" Bearings are daily carrying.

NORMA-HOFFMANN BEARINGS CORPORATION  
STAMFORD, CONN. . . . U. S. A.

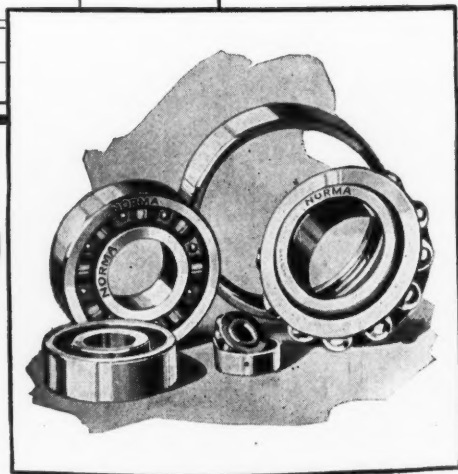
"NORMA" Closed Type Precision Bearings on the main shaft carry all the load—radial and thrust—of the "Homelite" Pump shaft.

The Homelite Corporation also uses "NORMA" Precision Ball Bearings exclusively on its "Homelite" Portable Generating Outfits.



## "NORMA"

### PRECISION BALL BEARINGS





## ***Solid, Integral Flanges by the AJAX Upsetting Method***

RECENTLY the problem was put up to us of forming the brake flanges and thickening the wall at the wheel bearing seats of Murray Butt Welded rear axle housings.

The method contemplated was to take housings enlarged at the ends and kinked so that the only work to be done by the Ajax Upsetting Forging Machine was to fold the enlargement to form the brake flange and to thicken the wall at the bearing seat.

This method would eliminate the objectionable welded or riveted joint between the housing proper and the bearing seat but would leave a seam in the brake flange which was not desirable.

Upon the recommendation of Ajax Engineers, it was decided to produce the hous-

ings with long straight ends in the press and welding machine, which considerably simplified both operations, and then in the Upsetting Forging Machine to upset these ends to form the flanges and thicken the walls at the bearing seats.

By following this practice not only is the usual joint between bearing seat and housing proper eliminated, but also the fold in the flange is done away with, making it absolutely solid.

Combined with the thorough desirability, from the engineering standpoint, of these housings with solid, integral flanges, is their low production cost. We shall be glad to explain the Ajax Upsetting Method to you and prepare details on your particular housings.

### **THE AJAX MANUFACTURING COMPANY**

621 Marquette Bldg.  
140 So. Dearborn St.,  
Chicago, Ill.

**Euclid Branch P. O.  
Cleveland, Ohio**

1369 Hudson Terminal  
50 Church St.,  
New York City

# A J A X



# Truck Rear Axle Drive Gears

Cut in

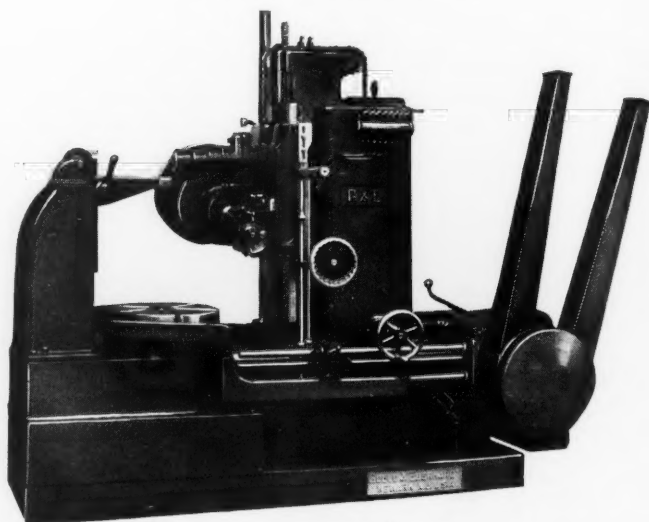
50 Minutes Each  
Floor to Floor



These gears are finish-hobbed in two cuts, cutting three gears per setting. A double-thread hooked hob is used for roughing and a single-thread finish ground hob for finishing.

Compare this production and method with your own.

36-HS Manufacturing  
Gear Hobber



## GOULD & EBERHARDT

NEWARK (Irvington), N. J., U. S. A.





# INTERNAL DISPLACEMENT FORGINGS

(National Process)

**P**ROGRESSIVE piercing, or forging by "internal displacement," has come to stay. While some are still doubting the practicability of this new economical method of forging parts, it is now being done. This method is standard practise in forge shops equipped with National High Duty Forging Machines.

Doubters are right in one respect—old style equipment cannot produce such work. The alignment and accuracy required to produce low cost, close limit forgings by "internal displacement" are obtainable only in the new National High Duty Forging Machine.

Great economy is secured because the exclusive National design reduces to a minimum the amount of metal to be removed by machining.

Practically all the material in these forgings is displaced—not punched. These holes are so accurately pierced that the forgings go *direct to the broach without reaming or drilling*. The result is an immense saving in metal and in labor.

The heavy, distorted, old fashioned, solid upset is rapidly becoming obsolete.

Besides perfecting the National High Duty Forging Machine for displacement forging, National engineers have developed many special forging methods, which are covered by patents and patents pending. These are reserved exclusively for users of National High Duty Forging Machines.

THE NATIONAL MACHINERY COMPANY, TIFFIN, OHIO, U. S. A.

Sold by

**CHAMBERSBURG—NATIONAL**  
COMPLETE FORGING EQUIPMENT

Sales Offices

CHAMBERSBURG, PA.  
Derbyshire St.

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Greenfield & Stanton Sts.

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152 W. 42nd St.

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2457 Woodward Ave.

# New Limits of Speed, Accuracy and Profits

The name "Libby - International" has long been synonymous with the highest standards of turret lathe work—fast, accurate, profitable and dependable. And now the new "C-H" Model is presented. This machine retains all the advantages of the "A" and "C" type "Libbys," with the following new features: improvements that are an assurance of even greater turning efficiency and profitableness.

## Features

### Bed and Headstock

Cast in one piece with two longitudinal and cross ribs every twelve inches.

### Headstock

Alloy steel heat treated gears running in oil with Maag and Herringbone form tooth. All shafts on ball or roller bearings. Flat ways, extra wide and thick to absorb cutting strains.

### Main Spindle Bearings

Very best grade phosphor bronze quickly adjusted from outside.

### Slides and Ways

Carriage slide, cross slide and turret slide provided with oil reservoir for automatically oiling all slides and ways.

### Chuck

New improved design. Very heavy. New construction of jaws. Oil cup for oiling.

### Turret Slide

Cast in one piece over and under the back way with improved type taper gib for entire length.

### Turret Clamp Lever

At front of slide convenient for operator. Does not interfere with tools on turret head.

## Automatic Stops

For both turret and tool post. New design, quickly adjusted or set.

## Change Gears

Can be furnished for cutting up to 2-inch lead.

## Direct Motor Drive

Motor direct connected to end of main drive shaft, eliminating belts, idlers, chains, pulleys, guards, etc. No lost power. No one-way pull on bearings. Maximum efficiency of the motor secured. Armature cannot sag and injure commutator.

## Iron

An alloy mixture giving unusual wearing qualities and additional strength. Brinell hardness about 186.

## Oil Pan

One piece sheet steel welded. Pump mounted above pan.

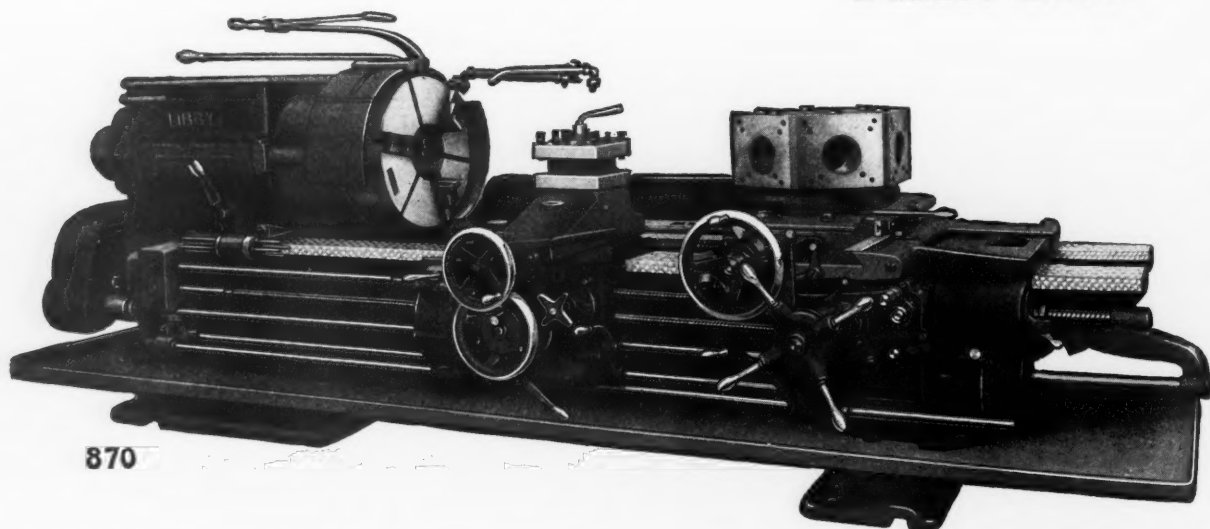
## Turret

Either rigid or power feed Cross Sliding Turret can be furnished.

*The complete catalog of the new "C-H" Libby is ready for your inquiry. Write for it; or, if you prefer, send a few blue-prints of your heavy chucking on bar work for time estimates. They will interest you.*

## The New Model "C-H"

## "LIBBY- INTERNATIONAL" Turret Lathe



## INTERNATIONAL MACHINE TOOL COMPANY Indianapolis, Indiana, U.S.A.

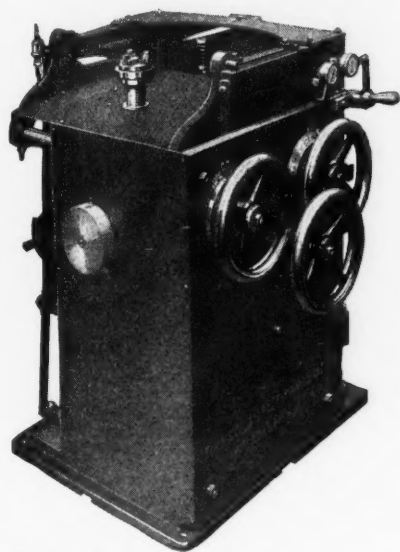
DOMESTIC AGENTS: Northern Machinery & Supply Co., Minneapolis, Minn.; Blackman-Hill & Co., St. Louis, Mo.; Briggs-Weaver Machy. Co., Dallas, Texas; Brown & Zortman Machy. Co., Pittsburgh, Pa.; The E. L. Essley Machy. Co., Chicago, Ill.; The E. L. Essley Machy. Co., Milwaukee, Wis.; Louis G. Henes, Los Angeles and San Francisco, Calif.; Mine & Smelter Supply Co., Denver, Colo.; Seifreut-Elstad Machy. Co., Cincinnati, Ohio; Seifreut-Elstad Machy. Co., Dayton, Ohio; Smith-Courtney Co., Richmond, Va.; Strong, Carlisle & Hammond, Cleveland, Ohio; Stedfast & Boulston, Inc., Boston, Mass.; Syracuse Supply Co., Buffalo, N. Y.; Syracuse Supply Co., Rochester, N. Y.; Syracuse Supply Co., Syracuse, N. Y.; Vandyck Churchill Co., New York, N. Y.; Vandyck Churchill Co., New Haven, Conn.; Vandyck Churchill Co., Philadelphia, Pa.; Vonnegut Machy. Co., Indianapolis, Indiana; Aumen Machinery Co., Baltimore, Md.; Peden Iron & Steel Co., Houston, Texas.

FOREIGN AGENTS: Coats Machine Tool Co., London, England; Ing. Ercole, Vaghi, Milan, Italy; Isbecque Todd & Co., Belgium; V. Lowener, Copenhagen, Denmark; Oslo, Norway; Stockholm, Sweden; Victor B. Mendoza Co., Havana Cuba; Aux Forges de Vulcain, Paris, France; Mitsui & Co., Japan; Rudel-Ryder Machy. Co., Toronto, Ont. and Montreal, Que.

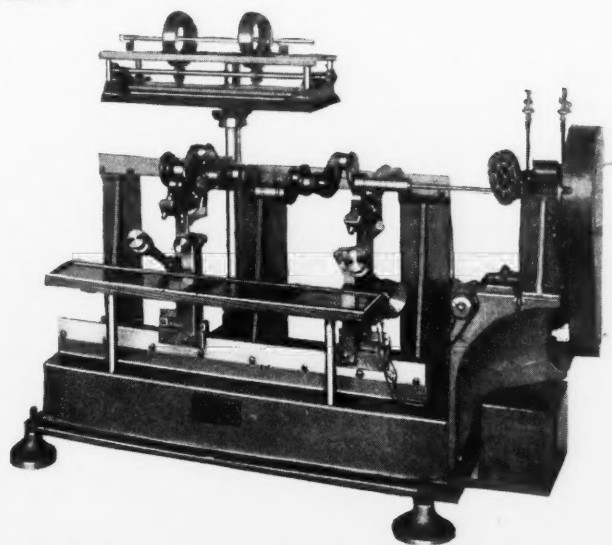
# OLSEN

## Balancing Machines

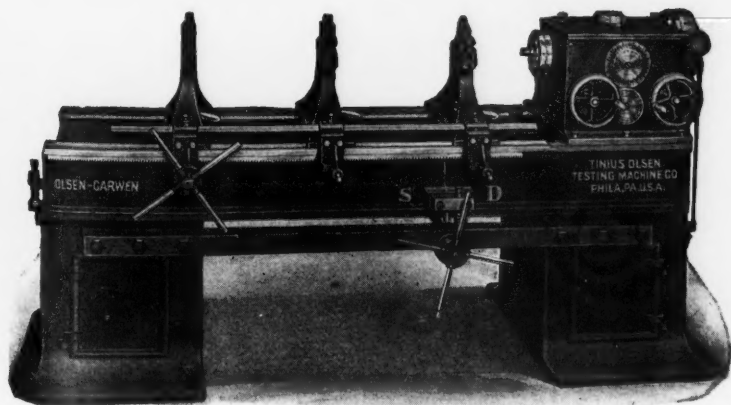
Complete Information with  
Unmatched Precision and Hour  
Saving Rapidity



Olsen Flywheel  
Balancing  
Machine.



Olsen-Lundgren Centrifugal Balancing Machine with new instantaneous Spark Indicating Dial, and Transfer Instrument.



Olsen Static-Dynamic Balancing Machine.

Olsen Balancing Machines offer a complete range of equipment embodying principles of design entirely new, and are without equal in completeness of data obtained, accuracy and simplicity of operation.

Olsen Static-Dynamic Balancing Machines determine both static and dynamic unbalance in parts up to 14 ft. long and weighing 15,000 lbs. without starting and stopping revolution to take readings, and without turning the part end for end in the machine. The Olsen Flywheel Balancing Machine provides maximum convenience and speed in handling parts with vertical axes.

And the newest and most amazing of all, the Olsen-Lundgren Centrifugal Balancing Machine. So simple that an inexperienced man can learn to run it in 15 minutes; so rapid that the entire operation of determining the exact point of correction for both static and dynamic unbalance, and its amount, can be determined in a few seconds.

*These machines will greatly reduce the equipment, time and labor required for putting your parts in balance. Let us supply complete details.*

**TINIUS OLSEN  
TESTING MACHINE CO.**

500 No. 12th Street

PHILADELPHIA, PA.

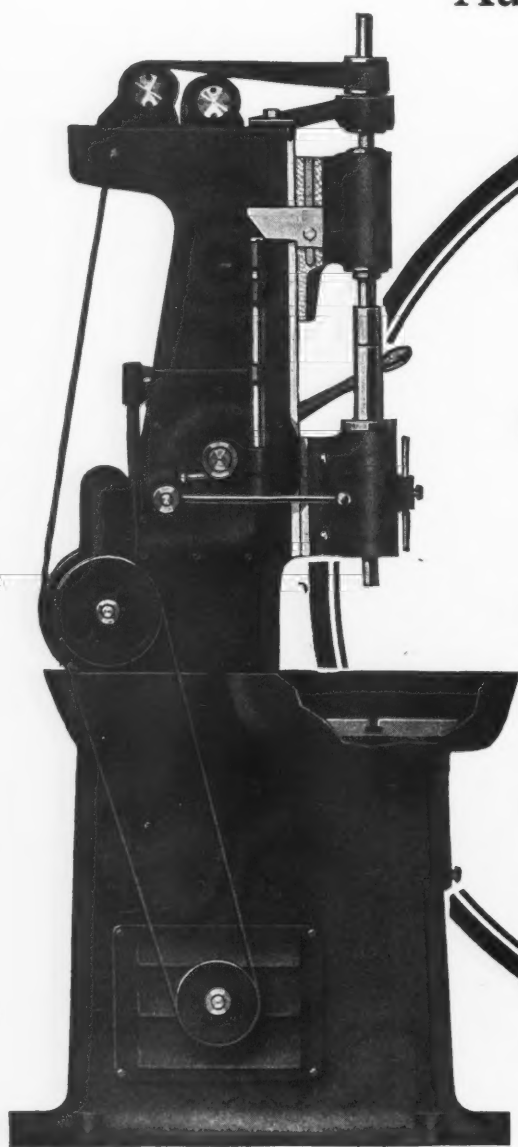
### Other Olsen Products:

Testing Machines and instruments for testing iron, steel, cement, springs, wire, chains, etc.; for Brinell hardness, tension, torsion, impact, and alternate stress.



*The New Single Spindle*  
**Coulter**  
*Automatics*  
**DIAMOND TOOL  
BORING MACHINE**

Is Unusually Profitable on General  
Purpose Work—Bearings, Bushings,  
Automotive Parts



Where very close tolerances and fine finishes are desired in the boring of non-ferrous metals, such as: Bronze, Brass, Aluminum, Babbitt, etc.—the

**New Coulter Diamond Tool  
Boring Machine**

is consistently proving itself in actual production.

Balanced and precision construction permits of consistent operation.

Ample provision has been made for work-holding fixtures.

Submit your finish-boring problems, and get the full story.

Other

**Coulter**  
*Automatics*

Hob Thread Millers  
Shaping Planers  
Profiling Machines

Designers and Manufacturers  
for 30 Years of Special  
Machine Tools

**THE AUTOMATIC MACHINE CO.**  
Bridgeport, Connecticut



# PROOF o' the PUDDIN' IS IN THE EATING



So, too, proof of the quality and long service of National-Cleveland Tools is evidenced by the steady, consistent growth of this organization from its small beginning in 1895 to its present four acre plant. National-Cleveland Tools are known the country over as being the finest cutting tools manufactured today.

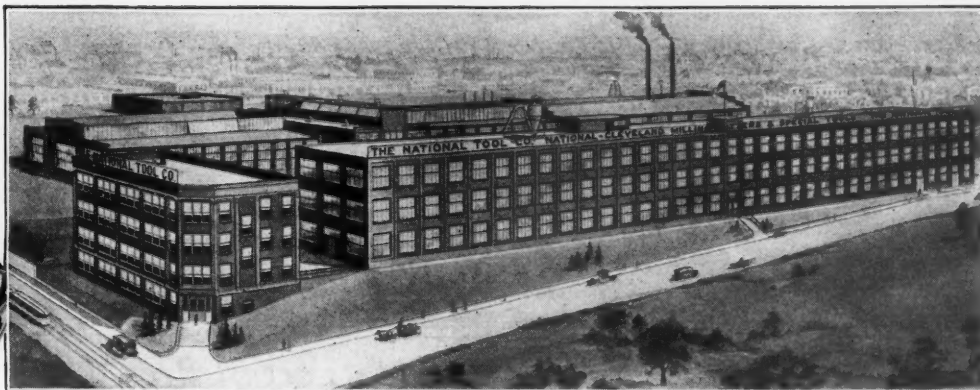
Concerns that have been using National-Cleveland Tools from the beginning of their manufacture, as well as constantly increasing new users, can give testimony that it pays to buy good tools.

When ordering cutting tools, always specify---

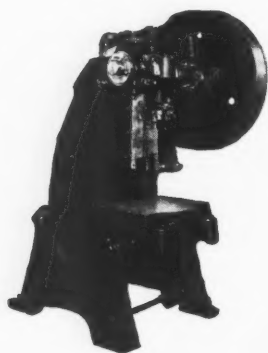
**NATIONAL-CLEVELAND**



**THE NATIONAL TOOL COMPANY**  
MADISON AVENUE AT WEST 112th STREET  
CLEVELAND, OHIO



# Announcing CANCO PRESSES



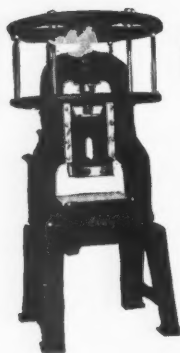
Open Back  
Inclinable  
Press



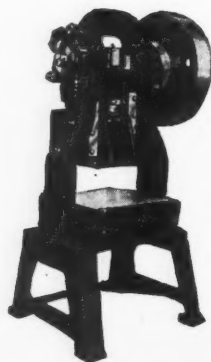
Toggle  
Press



Horn and Apron  
Press



Screw  
Press



Arch  
Press

**F**OR the past quarter century, engineers of the American Can Company have been solving the production problems that have come up in their 60 manufacturing plants. From this experience and research CANCO presses have been developed. Now they are offered to the metal working industries.

CANCO presses meet the requirements of the American Can Company for Safety, Durability and Production. They embody all the niceties of the precision machine tool—right materials, sturdy design, modern manufacturing methods. These features give the required results of greater productivity and longer life.

Literature describing the complete line of Open Back Inclinable, Horn and Apron Arch, Toggle and Screw presses will be gladly sent to you on request.

## CANCO FEATURES

CANCO 6 point clutch  
Brake—Cam actuated or  
treadle release  
Heat treated Chrome  
Nickel steel crankshaft  
Frame—Semi Steel  
Casting  
Scraped in Bearings

Extra length Gibs and  
Slide  
Increased Die Space  
Positive Knockout  
Improved Hardened Steel  
Punch Holder  
Finished surfaces for  
attachments  
Three Steps for Inclining  
Webbed Flywheel  
Dot Lubrication



*"Built by the World's Largest Press Users"*



# SPINDLE SPEEDS—

*Controlled without effort!*

as they are in Monotrol geared head lathes—means better and faster work produced at less cost.

Watch a Monotrol in action—and you see Power, Speed and Accuracy controlled, easily and quickly by the simple movement of one headstock lever. A lever that brings into motion correctly designed herringbone gears of the continuous tooth type—operating on Timken Tapered Roller Bearing Equipped Spindles,—delivering to the spindle nose the required power at the proper speed—for any and all cuts.

No Vibration, No Chatter, No Waste when Monotrols are doing the work!

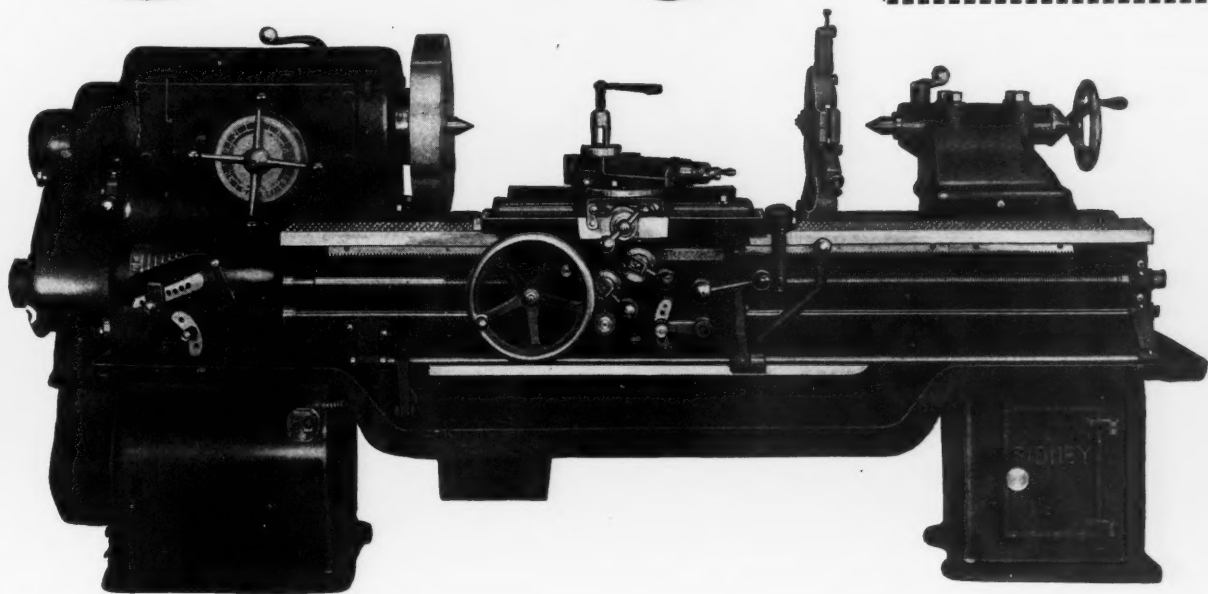
**The Sidney  
Machine Tool Co.**

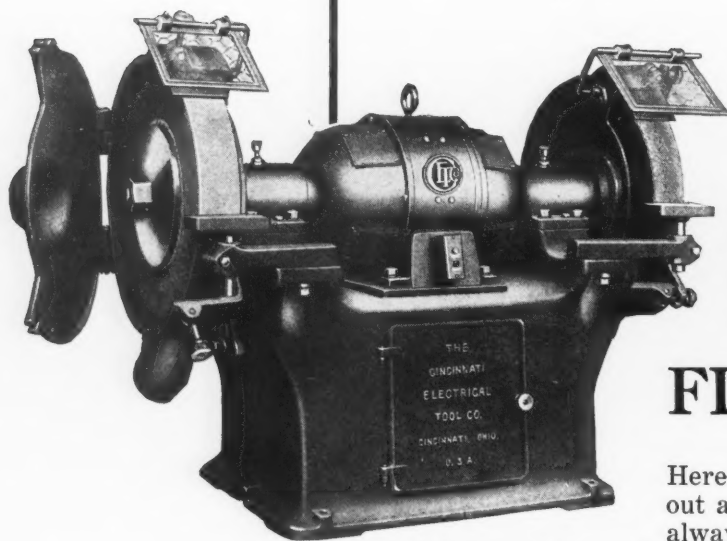
Sidney, Ohio

**MAIL Coupon TODAY**

Gentlemen: We would like to have you mail literature explaining the **NEW MONOTROL GEARED HEAD LATHE.**

.....SIZES.  
Name.....  
City.....State.....  
Address.....





## *The Ace of...* **GRINDERS** *The Cincinnati* **FLOOR GRINDER**

Here is the ace of grinders . . . ready to turn out a big day's work without grumbling . . . always on the job to carry a load that would

stagger other grinders . . . ideal for heavy grinding.

Built to carry ring wheels, 12-in. bore; a great factor in cutting initial costs and discarded wheel losses.

Timken Tapered Roller Bearings with latest model bearing mountings approved by Timken . . . a strong feature which assures you greater efficiency.

*Drop us a line today for full details.*

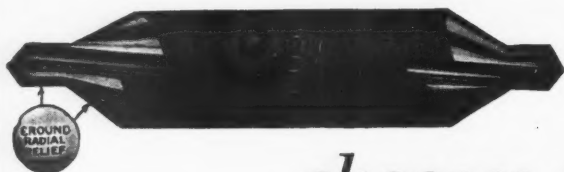
### **Three Sizes:**

5 H.P.  
7½ H.P.  
10 H.P.

## **The Cincinnati Electrical Tool Co.**

2674 MADISON RD.

CINCINNATI, O.



## **INDUSTRY** *chooses the inimitable* **Cogsdrill**



One of the most convincing proofs of Cogsdill's Centerdrill superiority is immediately in evidence when you try to match its performance.

With competition keener than ever before the Cogsdill Manufacturing Co. now enjoys more of the patronage of the country's great industries than at any time in the company's history.

A statement like this would not be possible were it not for the fact that

the original Cogsdrill is not being successfully imitated. It is still uniquely Cogsdill.

Small Diameter Drills bearing the trade name "Cogsdrill" are on a par with the Centerdrill and are demonstrating convincingly that greater possibilities can be expected of drills under 5/16 of an inch in diameter.

Test the Cogsdrills! Trial orders solicited. *Catalog on request.*

## **COGSDILL MFG. COMPANY, Detroit, Mich.**

# RENOLD BOSTON CHAIN DRIVES—Standardized in 1 to 100 Horse Power!



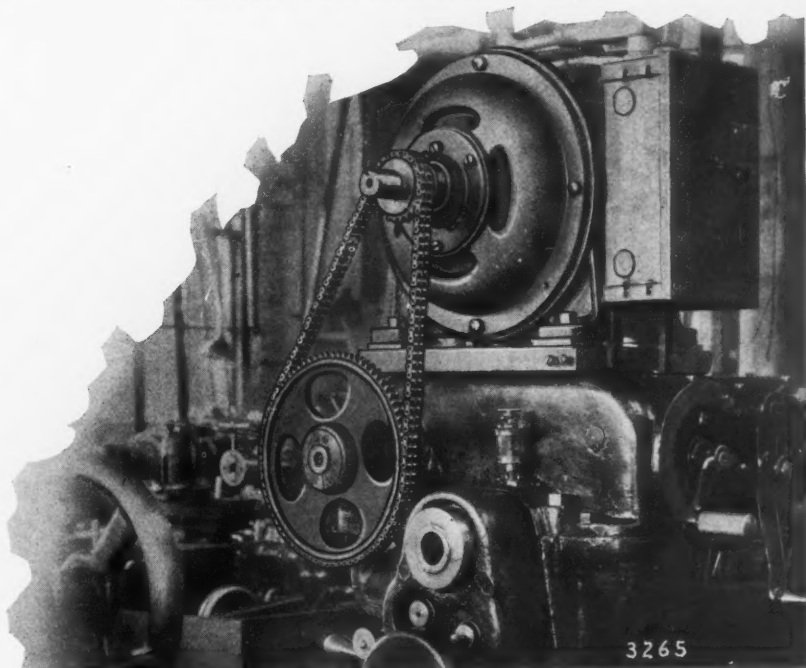
Every power transmission man should have a copy of this book.

The efficiency of Renold-Boston Chain Drives is as high as 99.5% under ideal conditions and even under ordinary conditions their efficiency is as high as 98%—and this high efficiency is maintained throughout the entire life of the drive.

These scientifically made chain drives meet almost every industrial chain requirement, and have proven very successful in thousands of diversified applications.

You can now get the right Renold-Boston Chain Drive, up to 100 H.P., direct from stock. Whether it's a silent or roller type which fits your needs best—the correct drive is ready for you.

Use this book:—"Renold - Boston Chain Drives" and quickly and easily select the proper standardized chain drive. In addition to simplified selection charts the book contains specifications and prices of nearly 1300 *standardized* chain drives for industrial use.



5 H.P. Renold-Boston Duplex Roller chain driving an American Lathe.

BOSTON GEAR WORKS SALES COMPANY, Norfolk Downs, Mass.

BOSTON  
34 Oliver St.

NEW YORK  
151 Lafayette St.

PHILADELPHIA  
11th and Arch Sts.

CLEVELAND  
1450 W. Third St.

CHICAGO  
955 W. Washington Blvd.

# BOSTON GEARS



# *Another New* Gisholt

**GISHOLT**



**HIGH PRODUCTION  
TURRET LATHES**



**Gisholt Machine Co.**

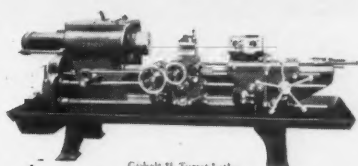
**Madison  
U.**

**S.**

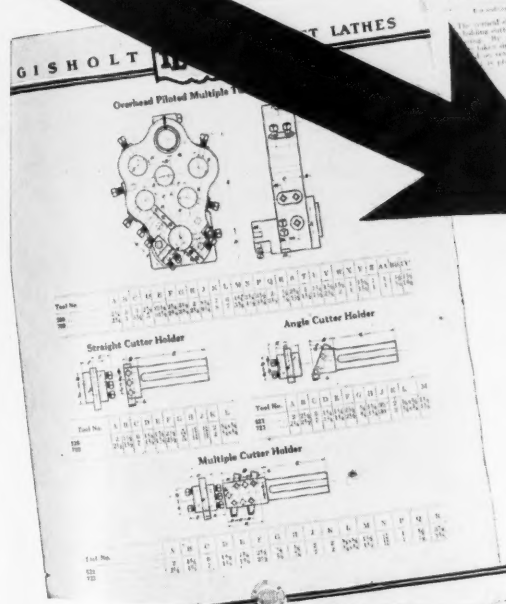
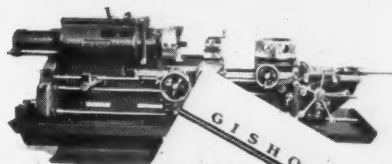
**Wisconsin  
A.**

## Describing the

**Fill in Coupon and return it attached to your company letterhead, or write us for your free copy.**



**Casholt H. Turret Lathe**  
With fixed center turret, automatic chuck and taper attachment.  
Price on Request.



Gentlemen:

Please send me a free copy of your new 1L and 2L High Production Turret Lathe Catalog.

Name.....

Company.....

Address.....

I have not received a copy of the new Heavy Duty Turret Lathe Catalog. Send me one without obligation.



## The Production Manager on the carpet

Another shutdown! The general manager demands to know why. And the production manager has the foreman of "No. 6" on his own official carpet in order to find out—

**Production Manager**—"Jones, this is the third time in two weeks that you've been in trouble with that line of machines down there in 'No. 6.' When 'No. 6' stops half our production is cut off. Now this condition has passed the explanation stage. We've got to find the 'bug.'"

**Foreman**—"Mr. Wilkins, we know what the trouble is, but so far we've not been able to stop it. It's poor lubrication. It's the bearings on those type-4 machines. And I can't do a thing about it until I get an O. K. to change the lubrication system."

**Production Manager**—"I'll get you the O. K. if you can show me that a change in lubrication will stop the trouble."

**Foreman**—"I sure can prove that. In my department there are 38 machines of the same type but of four different makes. Two of these machines came into the plant with the Alemite system standard equipment. They're not causing the trouble. Not one of them has failed since we started our present schedule. But it's three separate jobs to keep the other machines lubricated. Some bearings have grease cups, others oil cups, and still others are just tapped with oil holes. Careful as we are, we can't keep those bearings from going dry and burning out. Give me the Alemite system on all of those machines in my department and I'll guarantee a big drop in the number of shutdowns."

**Production Manager**—"I see your point. And you'll get your O.K. before noon. Make an estimate of how many Alemite fittings it will take to equip your whole department."

IT'S an odd fact that in many plants today where efficiency of production processes has been worked out to a high degree, lubrication is still a hit and miss proposition.

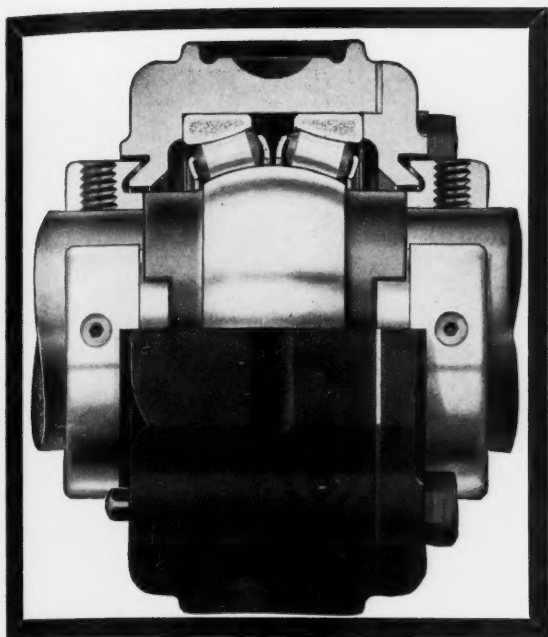
Where it takes two or three separate operations to lubricate a machine men naturally will neglect some bearings. This neglect reflects itself in mechanical troubles and unnecessarily high repair and replacement costs.

The Alemite system is simple, direct and positive in its results. Even your open oil holes can be closed and systematically lubricated by the Alemite-Zerk Barrel to Bearing system.

Write today for the "Barrel to Bearing" Booklet.

**BASSICK MANUFACTURING COMPANY**  
2636 N. Crawford Ave Chicago Ill



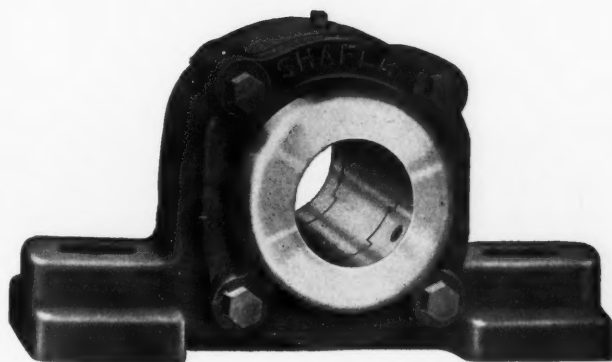


# SHAFER

*"Self-Aligning"*

## PILLOW BLOCK— HANGER BEARING

### *Shafer Design Saves Power Minimizes Wear*



Shafer Bearings are automatically *self-aligning*—their unique, patented design eliminates all possibility of power loss and rapid wear from pinching and binding of rollers. It has been conclusively proven that after millions of revolutions under load, the wear of Shafer Bearings has not been sufficient to require further adjustment.

Shafer Self-Aligning Pillow Blocks and Hanger Bearings are being adopted as standard for all machine and plant equipment by a rapidly increasing number of reputable manufacturers.

*Send for details, let us tell you why  
Shafers will save you money*



**SHAHER BEARING CORPORATION**  
6501 W. Grand Ave., CHICAGO, ILL.

173 Lafayette St.  
New York, N. Y.

6404 Jefferson Ave. E.  
Detroit, Mich.



## **XLO DRILL BUSHINGS**

### **▲▲ A CONSTANT SUPPLY**

Ex-Cell-O drill jig bushings are so simple in design that in case of emergency you could make them in your own shop without special tools or fixtures—and with only the specifications in the Ex-Cell-O catalog. The tremendous Ex-Cell-O stock of more than 200,000 bushings and our policy of “same day” shipments makes such an emergency far from probable—but the safety element is there if it ever is needed.

For every standard drill size from No. 55 to two inches, there are either twelve or twenty-four standard Ex-Cell-O drill bushings, offering a choice of head-or-headless press-fit types, and plain-or-slip renewable types, in three to six standard lengths—and they're made of tool steel!

A new Ex-Cell-O bushing catalog is just off the press. It will be mailed together with price list upon request.

# **EX-CELL-O TOOL & MFG. CO.**

---

**1465 E. GRAND BLVD. **XLO** DETROIT, MICHIGAN**

# Getting *the* Jump is what Counts



Manufacturing competition is a lot like a foot race. The man who gets the jump usually wins. The production executive who is an independent thinker recognizes this fact and makes every effort to keep his company a little ahead of competitors. As a means to this end, he promptly investigates new materials and equipment for which the producers make unusual claims.

Many alert manufacturers have been quick to seize the advantage offered by CIRCLE ©, the extraordinary new HIGH SPEED STEEL. Sooner or later,

this new type will displace for general use, the old standard high speed steels that have been "the last word" up to the present time. Then the benefits of its superior qualities will be equalized among all users. Until that time, however, those pioneers who are speeding up their production with CIRCLE © enjoy a substantial lead in the competitive race.

To those interested in progress and profits, we offer a sample Tool Holder Bit in any standard size up to 7/8" square, free on request.



Send for this Booklet

## FIRTH-STERLING STEEL COMPANY

General Offices and Works: McKEESPORT, PA.

NEW YORK  
BOSTON

PHILADELPHIA  
HARTFORD

Globe Wire Division, SHARPSBURG, PA.

DETROIT  
CLEVELAND

CHICAGO  
LOS ANGELES





© M. F. C. 1928

# Stop PAYING DOUBLE for Excess Weight

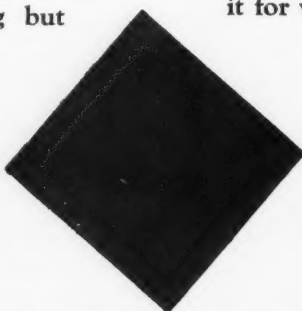
**Y**OU pay twice for excess weight. First in money, for steel and parts cost money. Next in man power, fatigue and reduced output.

More power—less weight. That's the secret of drill value. This new 1/2" drill gives it. Stripped for action. Nothing but strength where needed.

The net result to you is increased output, lower cost, better satisfied workmen and more profit. Remember this drill has full 1/2" in steel capacity. No overheating. Long life. Ability to stand

up in hard use and always performance that challenges comparison with any other drill ever made.

And the price is only \$54.00. Here is drill value. But don't take our word alone. Prove it for yourself. Arrange a test — on your own work. Then you'll insist on MILLERS FALLS drills. Get in touch with our local distributor or write for his name. No obligation till you satisfy yourself that on every count you want a MILLERS FALLS.



**MILLERS FALLS COMPANY**  
Millers Falls, Massachusetts

NEW YORK: 28 Warren St.

CHICAGO: 9 South Clinton St.

A New

# Norton Lapping Machine

*With a number of distinctive  
and important features*

A new Norton machine that is an important contribution to the progress of production lapping. The general design is based on well proven lapping principles but embodies many improvements and refinements in construction.

## Features

Abrasive lapping wheels instead of cast iron laps

Result—Very rapid removal of stock

High finish

Extreme accuracy

No subsequent washing operation

Power operated mechanical device moves upper lapping wheel to and from work.

Variable feed pressure for different types of work and amounts of stock to be removed.

Pressure automatically released when upper lap is raised from work.

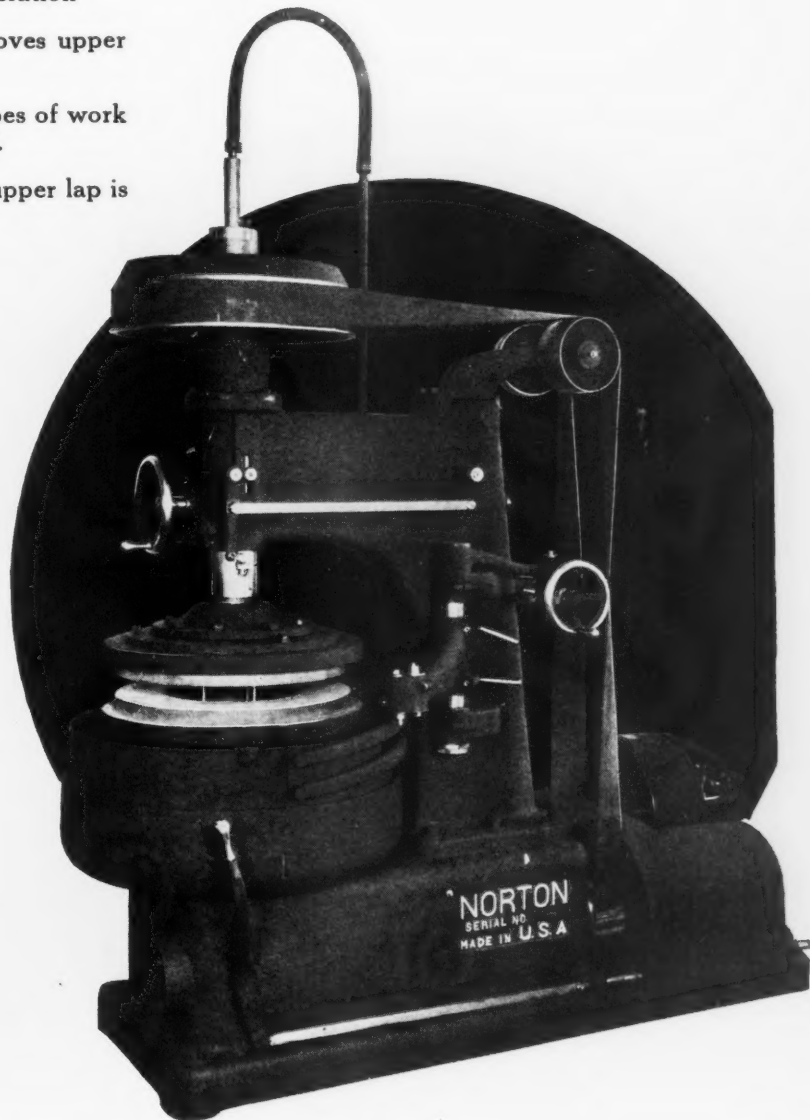
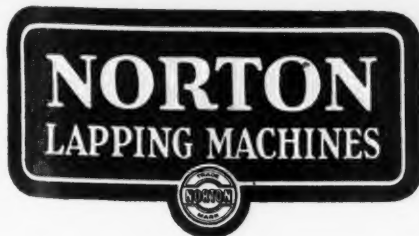
It is built throughout to the well known Norton standards. It has the strength and rigidity necessary for steady, dependable operation over a long period of time. Thirty-two ball bearings assure smooth, easy running.

The machine can be supplied in two types, one for cylindrical work and the other for flat work, and is recommended for the lapping of piston pins, small shafts, piston rings, sides of ball races and similar work.

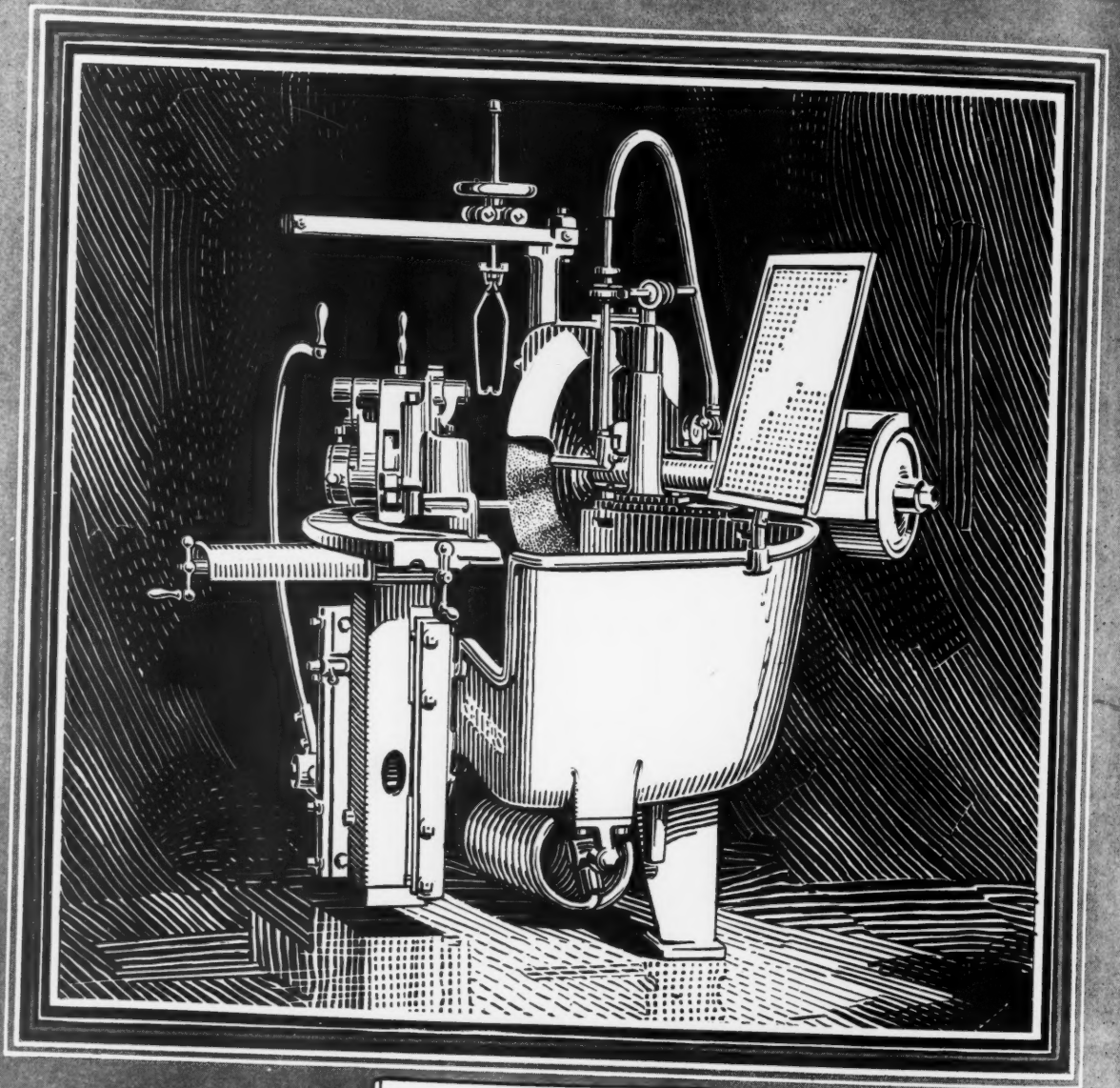
NORTON COMPANY, WORCESTER, MASS.

New York Chicago Detroit Philadelphia  
Cleveland Syracuse Hartford

L-7



# Grind your



**SELLERS**  
TOOL GRINDER



# ***Tools Uniformly***''

Tool steel is expensive. Do not grind it away needlessly. The Sellers Tool Grinder duplicates the exact required angles and shapes of cutting tools and grinds away only the minimum amount of metal necessary to restore the correct shapes. It is a double-purpose machine in that it produces new tools from rough forgings as readily as it retouches the daily run of dull tools. It is unusually easy to operate.

A Sellers Tool Grinder in your tool room will assure you of tool-uniformity—and will effect savings of cutting time and tool steel that are truly remarkable.

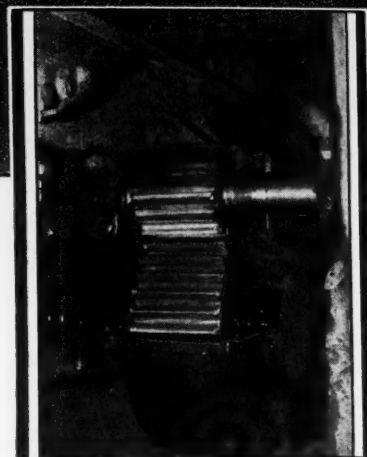
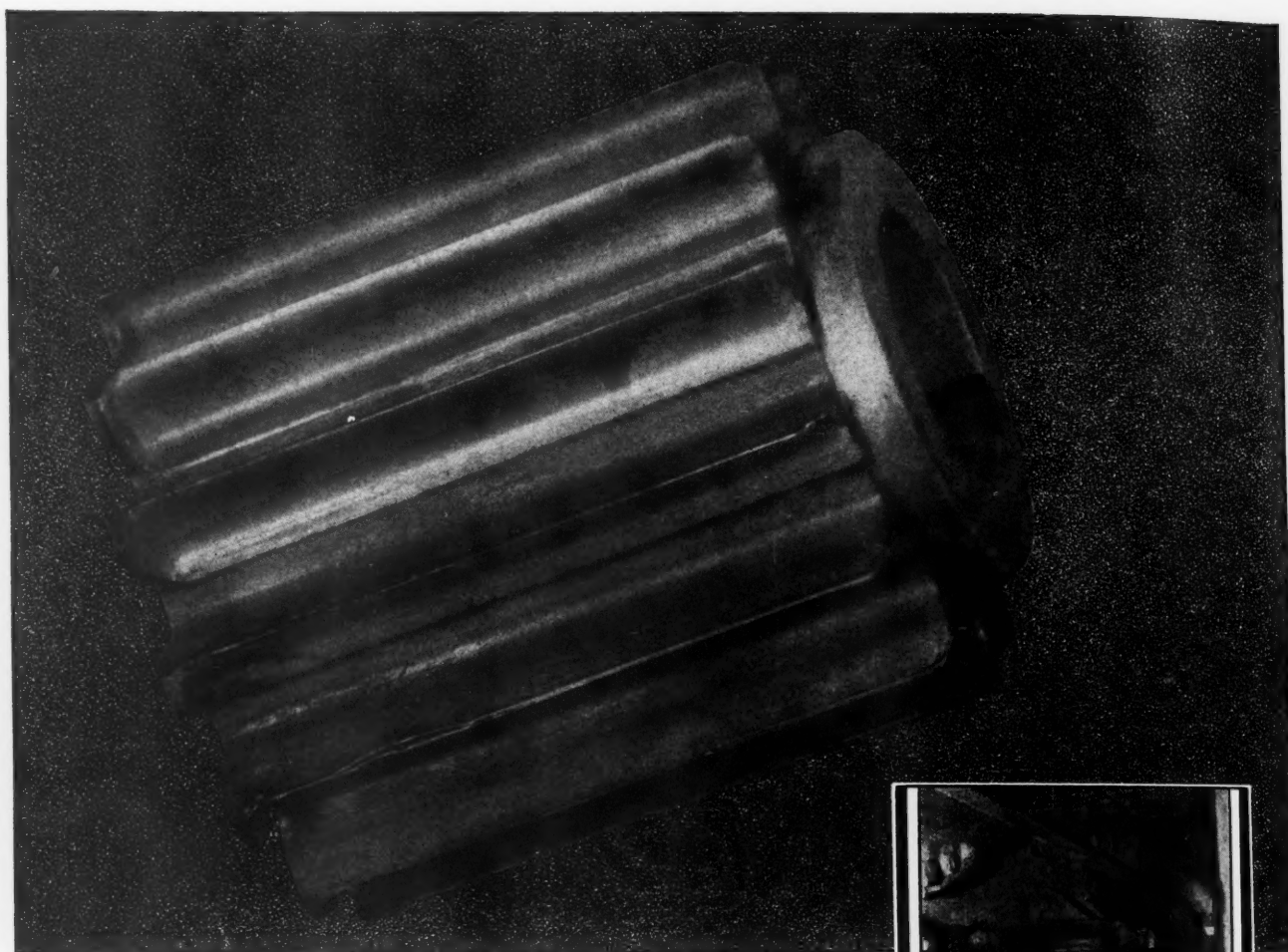
Sellers Tool Grinders are built in two sizes—for tools up to 3" x 3" section, and for tools up to 2" x 1½" section. A bulletin describing their many distinctive features will be mailed at your request.

*We also manufacture:*

Planers; Drill Grinders; Large Boring and Turning Mills; Floor Boring and Milling Machines, both floor plate and planer type; Slotters; Sand Mixers for foundries; Railway Shop Tools.

**WILLIAM SELLERS & CO. INCORPORATED**  
*Philadelphia, U.S.A.*





## You Should See The Other 13 "Fellows"

This one sand mill pinion, cast from Sivyer Chrome Nickel Steel, did the work of 13 ordinary castings. It withstood, for an entire year, the severe, abrasive wear that had been sending other pinions to the scrap heap every three or four weeks. Even after a year, the Sivyer pinion showed no cracks—no fractures—no bent teeth. And the Scotch plant engineer insisted it was good for at least another month.

Service such as this, which has been duplicated for two successive years, explains why industrial leaders have come to think of resistance to hard and abusive wear in terms of Sivyer alloys.

# SIVYER STEEL

SIVYER STEEL CASTING COMPANY, MILWAUKEE

---

# Production Must move Forward!

**P**RODUCTION *must* move forward! Progressive operation tolerates no laggards in the line! A single balk at any crucial point will throw a whole plant out of gear! That is why more and more industrial plants are turning to Gas for their fuel.

Gas is the fuel subject to the fewest interruptions. It is always available, always dependable, always adjusted *on the instant* to meet the exact requirements of any production problem.

Heat is the essence of practically all manufacture. In a very positive and a very important way, Gas plays its part to keep your production *always* moving forward.

For information about the use of Gas in *your* plant, inquire of your Gas Company, or write to

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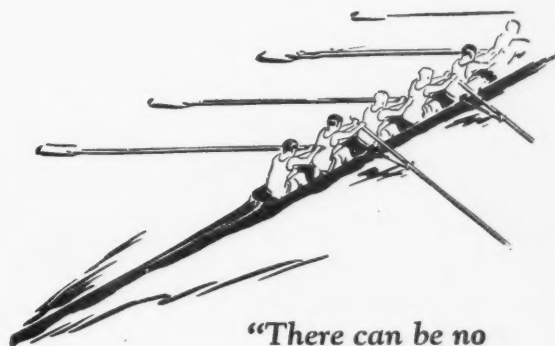
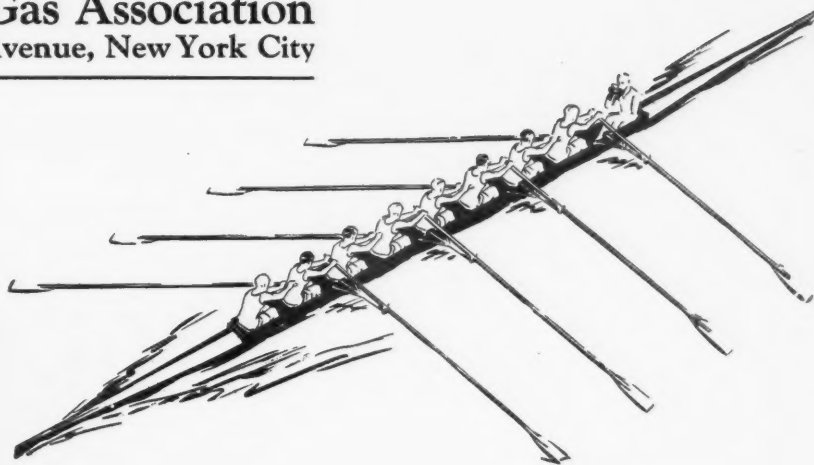
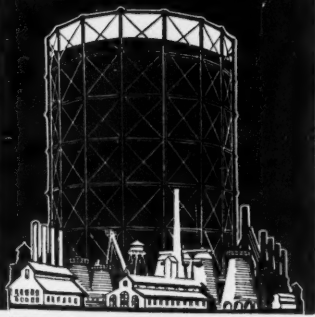
**American Gas Association**  
420 Lexington Avenue, New York City

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#### Send for Book

Write to American Gas Association for new book, "Industrial Gas Heat". It's free.

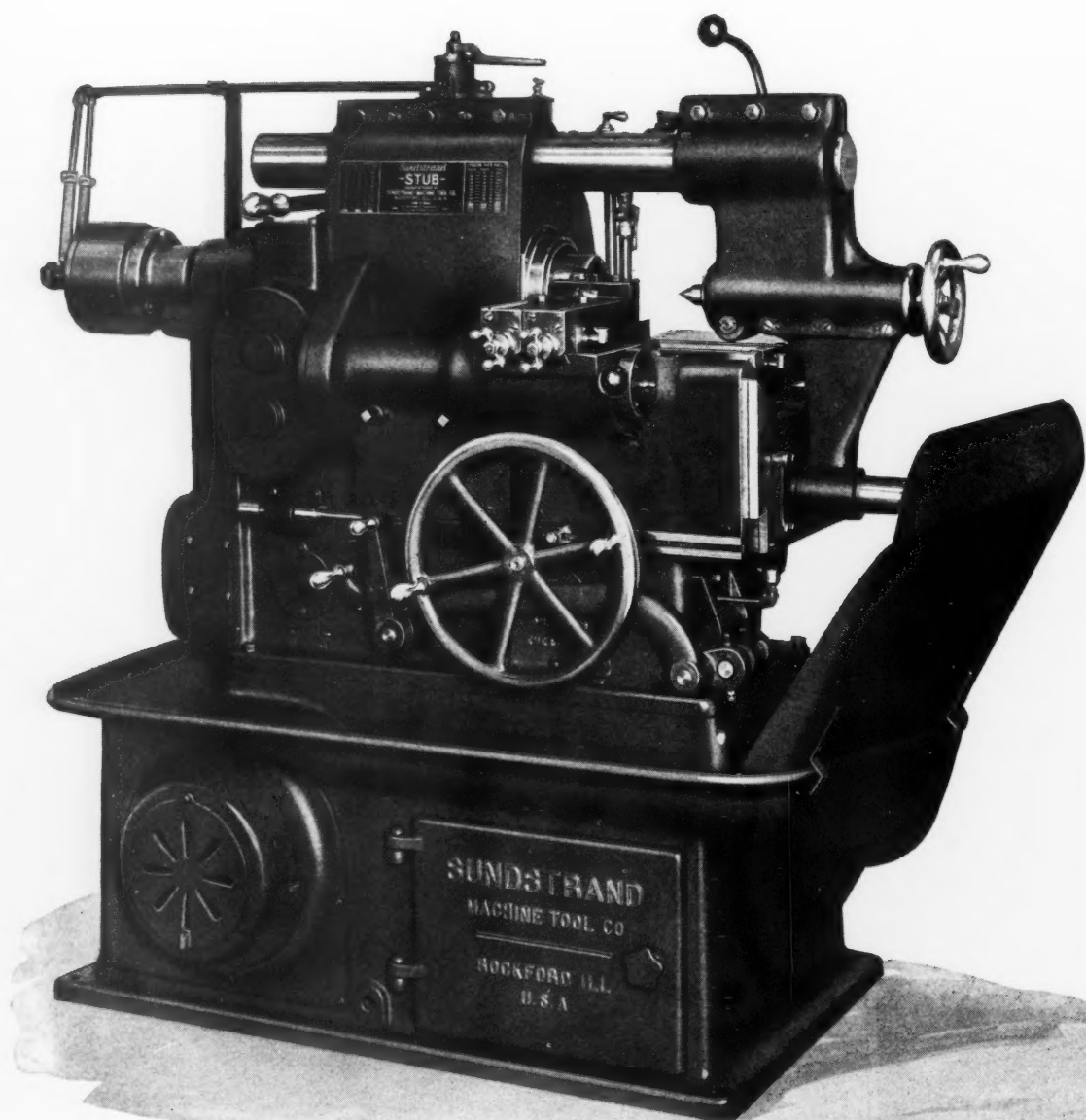
You can  
do it better  
with **GAS!**



"There can be no  
interruptions"



# *Do You*



**STUB**  
LATHE

**Sundstrand M**  
*Milling Machines-Lathes*  
**ROCKFORD**

# Realize...?

Do you realize the vast extent of Sundstrand Stub Lathe applications? Illustrated, for example, is an out-of-the-ordinary piece of work—the generation of two cams on one piece of steel at the same time. Of particular interest is the fact that, while they are alike in form, the cams are located differently around the circumference of the piece.

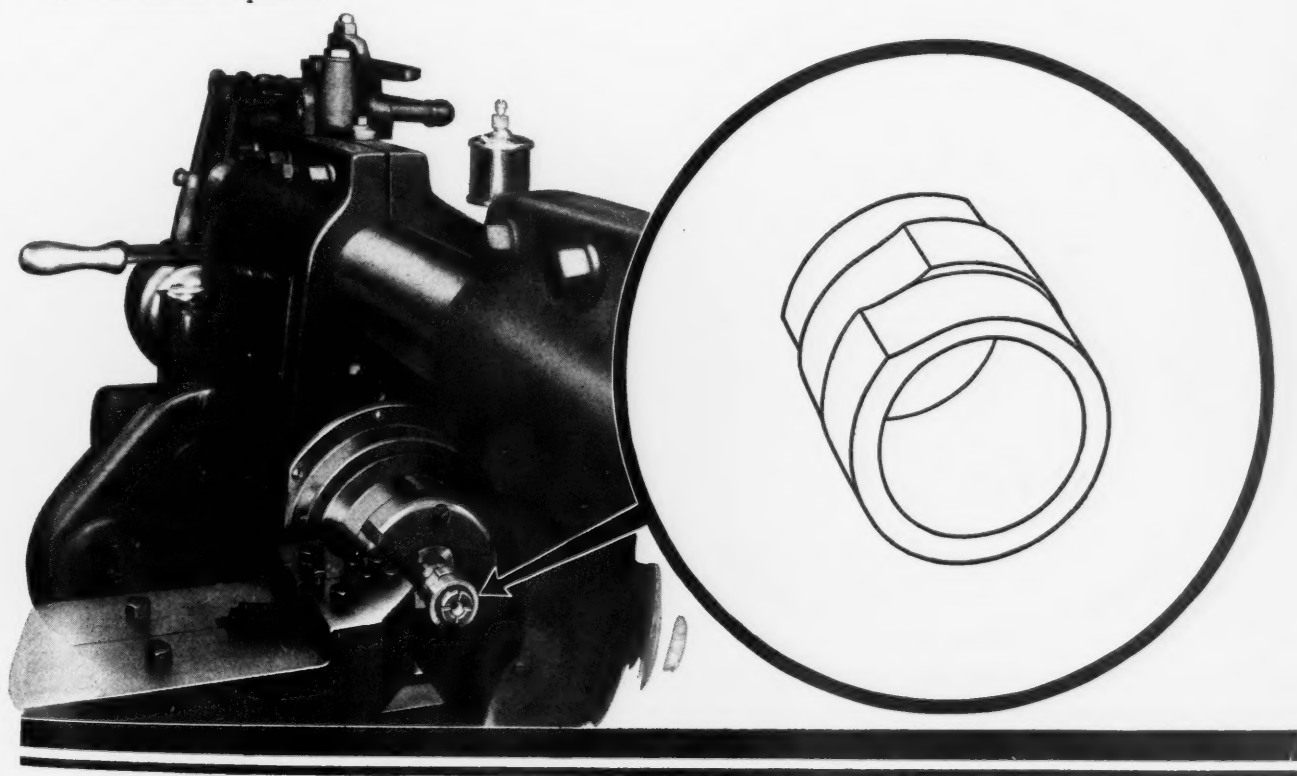
As put to Sundstrand engineers the proposition was—"Can you produce this part complete in one operation?—How?—and How fast?" The answer as worked out, is a Sundstrand Stub Lathe having a special carriage equipped with two independent tool slides. That it is a satisfactory answer from every angle of operation and output is demonstrated by the fact that the equipment is in successful operation on production work in the customer's plant.

This is but one example of the remarkable work that is being done by Stub Lathes in hundreds of shops—and new applications are being developed constantly by Sundstrand engineers cooperating with manufacturers in many different fields.

If you have turning that comes within the capacity of Stub Lathes—8" or 12"—as to length and diameter, even in lots that require only one day's run—investigate the possibilities of Stub Lathe applications for increasing production, improving quality, cutting cost, saving floor space—greater profit.

NOTE: The same thing applies to Milling—Rigidmilling.

*Send samples to Sundstrand for production proposals*



**Machine Tool Co.**  
*Centering Machines—Balancing Tools*  
ILLINOIS, U.S.A.

# BUSHING COST



**MAINTENANCE  
INSTALLATION  
PRICE**

**UNIVERSAL  
LINER  
EASILY AND  
QUICKLY  
INSTALLED**

**UNIVERSAL  
OCTAGON HEAD  
EASILY AND  
QUICKLY  
REMOVED AND  
REPLACED**

**UNIVERSAL  
PRICES  
ARE  
EQUALLY  
LOW**

**A  
PRODUCT  
OF**

**UNIVERSAL  
ENGINEERING CO.**

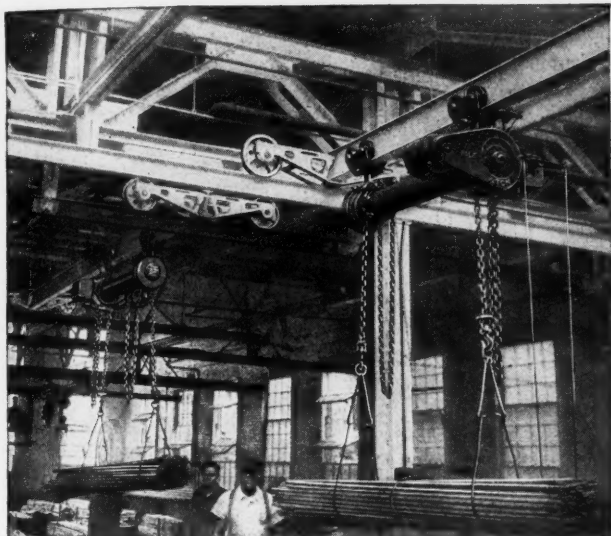
**FRANKENMUTH, MICH.**



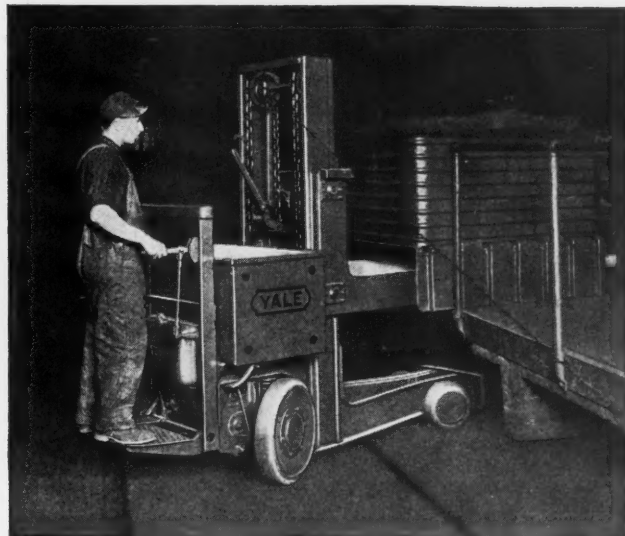


TRADE **YALE** MARK

## YALE HANDLES LOADS BETTER YALE EQUIPMENT IS BEST



*An Installation of Single I Beam  
Cranes with Electric Twin Hook Hoists*

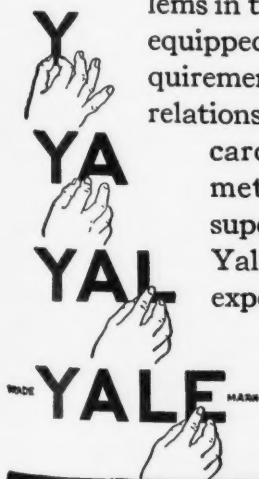


*YALE K22 Elevating Platform Truck  
handling a metal box skid of castings*

Co-ordinate your production through scientific handling of all materials and work in progress.

Our engineers have extensive practical experience gained in co-operating with many industries—an experience Yale makes available to every plant, but which no one plant alone could acquire.

Place your plant material handling problems in the hands of your man best equipped to co-ordinate your requirements on the basis of studied relations to work in progress. Discard haphazard and costly methods, and utilize Yale superior handling equipment. Yale offers you without cost expert consultation and affords



you lowered production costs. Yale equipment will definitely pay for itself several times a year.

Each Yale part is made with expert care not merely that it be a perfect part but that the entire truck, tractor, trailer, chain block, electric hoist, trolley, hand traveling crane, winch, assembly, etc., may permanently function with maximum maintained efficiency. Each piece of equipment is designed to best perform certain types of work.

Supplemental equipment such as skids, cranes, lifting forks, etc., imparts a great diversity of uses, and a great versatility to Yale Electric Industrial Trucks. Yale will definitely save you money, give you lowered costs and increased profits. Write today for details.

The Yale & Towne Mfg. Co., Stamford, Conn., U. S. A.  
Canadian Branch at St. Catharines, Ont.

**YALE MARKED IS YALE MADE**

### **Hoisting<sup>and</sup> Conveying Systems**

# It Will Pay You!

to Use the  
Best Stamps



It costs no more to use the *best* marking stamps. The added value Thors return in service, dependability, convenience and quality of work is certainly worth investigating.

A few of the superiorities of Thor Stamps are listed here. But we want you to have the whole story. Our new circular, "The Stamp With the Blue Head," we are sure will interest you. Where shall we send your copy?

**THE PITTSBURGH STAMP CO.**

810 CANAL ST., PITTSBURGH, PA.

*Makers of Thor Marking Tools*

## **A Few Features**

Unconditional Guarantee.  
Thumb Marking for ready identification.

"Blue Head," an acknowledged indication of scientific drawing and tempering.

Deep Engraving, that stands up under the hardest service.

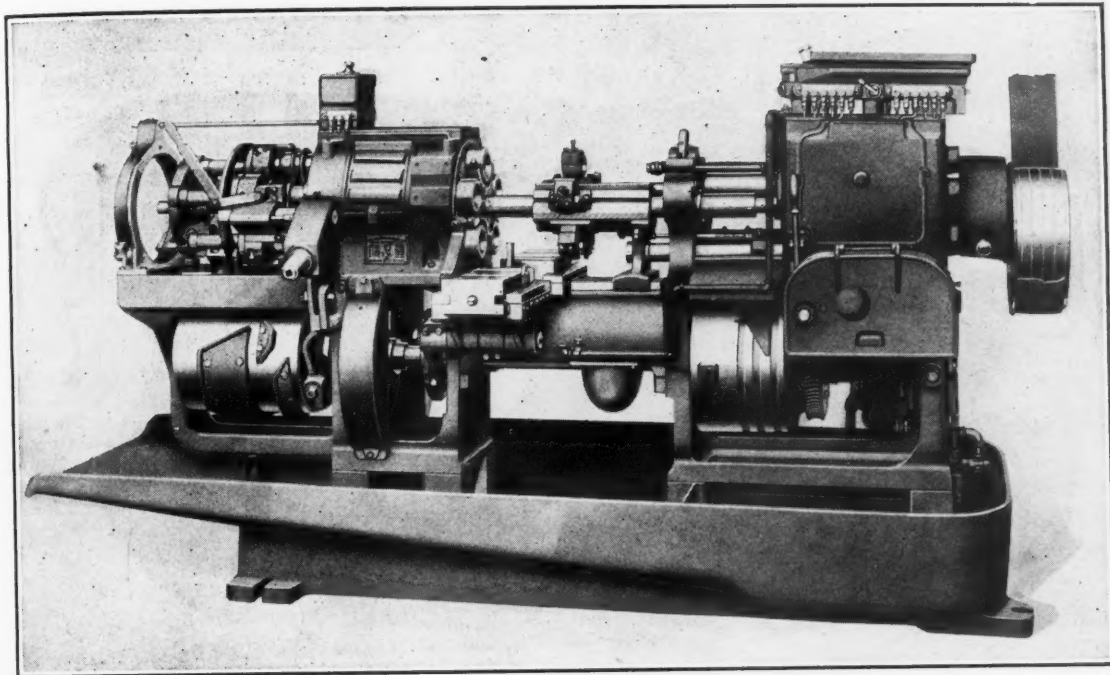
Stamps are Twins—each stamp individually turned to uniform size and centrally located striking point.



# Thor



# Speed!



## 5-Spindle Acmes Are Fast — They Are Also Dependable

*Speed* and *Dependability* are prime necessities today in successful machinery—whether it be automobiles or the production machine tools by means of which automobiles and all other machines are built.

5-Spindle Acmes are *Fast* and *Dependable* because they are scientifically designed and carefully built. Not only this, but they have been given long and rigorous working tests by which the design and construction have been checked upon and through which they have been refined.

There was a time when there was considerable difference of opinion about the practicability of Multiple Spindle

Automatics and about their capabilities. While it is safe to say that in the minds of production men the questions have long since been settled in favor of Multiples—it is not as certain that all production men realize how *Fast* and how *Dependable* modern Multiples have become.

A demonstration of the latest 5-Spindle Acmes on your work will open your eyes to the *Speed*, the *Accuracy* and the *Low Cost* with which these *Dependable* Multiples will turn out your toughest jobs. A study of the 5-Spindle Acmes will reveal to you a surprising number of engineering refinements—each one of which contributes something toward *Speed*, *Accuracy* and *Dependability*.

5-Spindle Acmes are built in three sizes—9/16 in., 1 in. and 1½ in. Belt Driven or Motorized.

**The National Acme Company**  
Cleveland, Ohio      Windsor, Vt.

New York

Detroit

Chicago

Makers of Acme and Gridley Multiple Spindle Automatics, Gridley Single Spindle Automatics and Gridley Multiple Spindle Chucking Machines at Windsor, Vermont, and Namco Opening Dies, Collapsing Taps, Screw Machine Products and "Positive" Centrifugal Oil Separators, Clarifiers, etc., at Cleveland, O.





TOOLMAKERS  
SINCE 1893

Measured by the yard stick of performance—the only true indicator of value—THOR ELECTRIC DRILLS are considered the standard in all lines of industry.

First cost is not important in the purchase of an Electric Drill for production work. It's the performance that counts—the number of days and months a drill is on the job without requiring extensive repairs. For it is an undeniable fact that the cost of repairing a drill must be added to the original price to get the complete cost.

THOR welcomes such comparisons because they clearly prove THOR'S superiority and low cost.

THOR DRILLS are DESIGNED RIGHT—and BUILT RIGHT. Every part that goes into a Thor is tested—every operation is supervised by experienced men—every tool is checked, not once, but three times, before it leaves our factory. Nothing is left undone to assure you Electric Drills that will give the service you have a right to expect.

If you are interested in this kind of performance—and of course you are—we suggest that you let us show you what THOR DRILLS can do for you under your own conditions.

# INDEPENDENT PNEUMATIC TOOL CO.

PNEUMATIC TOOLS      GENERAL OFFICES      ELECTRIC TOOLS

600 W. Jackson Blvd. CHICAGO

FACTORY AURORA, ILL.

Eastern Office 1463 Broadway, New York



BRANCHES THE WORLD OVER

London Office 40 Broadway, Westminster, London



*We'd like to tell you how simple, convenient, profitable modern manufacturers find Grant Riveters—write us.*

**GRANT**

## Rotary Vibratory Riveters

*Assembling Parts for Vacuum Cleaners*

The modern housewife demands dependable equipment — mechanical labor saving devices must function efficiently and wear well or the result is commercial oblivion disastrous to the manufacturer.

Grant Riveters are used to assemble parts for Eureka Vacuum Cleaners. Grant Rivets—tight or loose—stay put as the designer intended, do their share to build the reputation of the Eureka Vacuum Cleaner Company's popular product.

**The Grant Mfg. & Machine Co.**  
N. W. Station, Bridgeport, Conn.

## GRANT Noiseless Rivet Spinners

*For Vibrationless Construction of Radio Parts*

Rigidity is a strong point in radio construction—on it depends service, reception and satisfaction. Grant Riveted, this case will stand up to the best work the manufacturer can put into the set, while the ease and economy of the operation help keep costs at a profitable minimum.

Send for details of Grant Rivet Spinners and their simple, noiseless operating system. Let our riveting experts get to work on your problem.





No. 456  
Starrett  
Gear Tooth  
Vernier  
Caliper

No. 438  
Starrett  
Vernier  
Caliper  
for  
measuring  
dovetail  
slides

With the Starrett No. 456 Gear Tooth Vernier Caliper, the thickness of a pitch line or chordal thickness of gear teeth, and the distance from the top of a tooth to the chords can be measured by thousandths of an inch.

For work on gear teeth, gear cutters, hobs, etc., this tool is almost indispensable.

The Starrett No. 438 Vernier Caliper for measuring dovetail slides entirely does away with fitting plugs or wires in the corners of the dovetails, and eliminates all fuss with center to center distances, tangents and co-tangents.

If your machine carriages and platens are dovetail fitted you will want this Vernier Caliper. Measures any dovetail whether 45, 50, 55, or 60 degree angle.

These are but two of the many special, time saving shop tools to be found fully illustrated and described in the Starrett Catalog. Write for free copy of Catalog No. 24 "D" today.

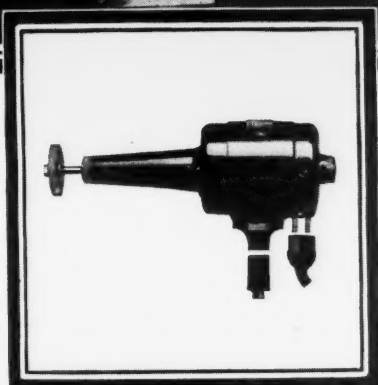
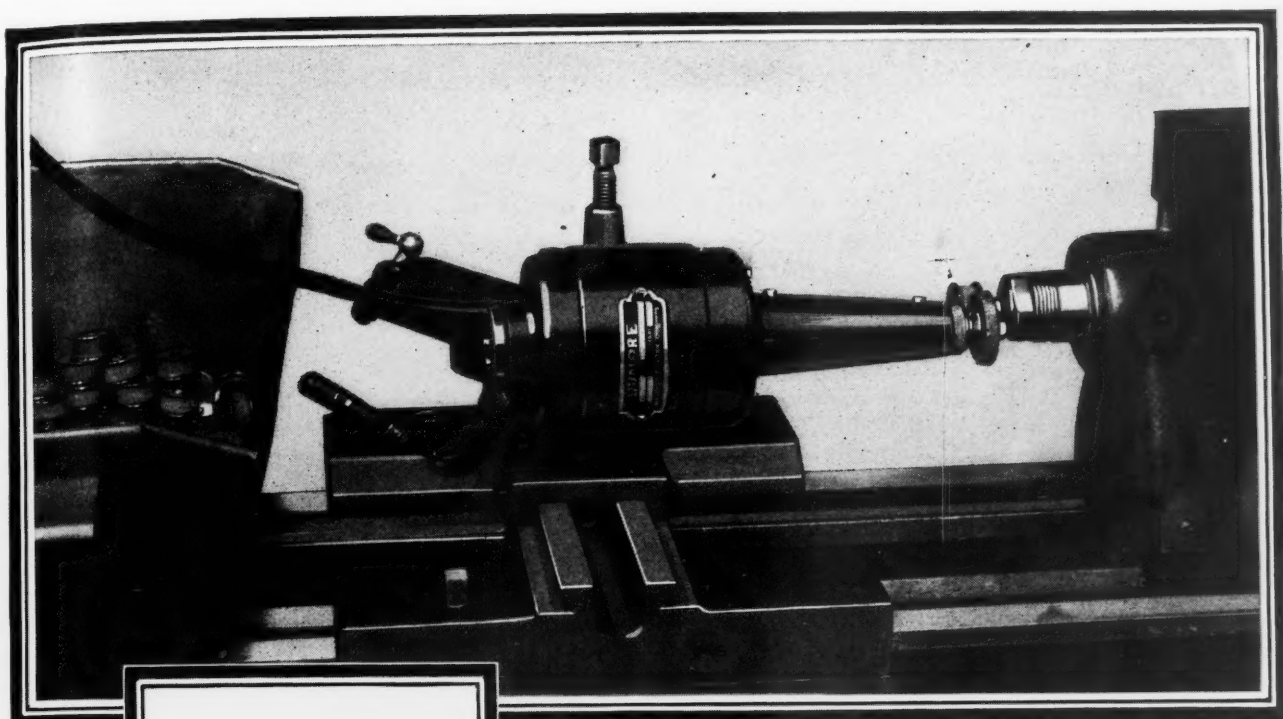
THE L. S. STARRETT CO.  
World's Greatest Toolmakers  
Manufacturers of Hacksaws Unexcelled  
Steel Tapes—Standard for Accuracy  
ATHOL, MASS., U.S.A.



# Use Starrett Tools

1997





#### A VALUABLE BOOK FREE

This book was compiled by an authority on tolerances, precision work and close fits. It will be of real value to you for reference purposes. Mail the coupon.

## Production Increased from 130 to 350 Pieces Per Hour

**R**EPLACING a cutting tool with a Dumore No. 1 J G Grinder set up as illustrated above, enabled the operator to turn out 350 pieces per hour, as against 130, which was the previous output on this job.

Such increases and savings are common wherever Dumore Grinders are used. The adaptability, speed, compactness and perfect balance of this equipment enable you to use it in many ways. New economies and production records can probably be established in your business by using Dumore Grinders.

The study and effort of our engineers have resulted in the development of money saving methods on many production jobs. This experience is at your service if you can use it. Mail the coupon for a copy of our new book "1/10,000 of an Inch."

### WISCONSIN ELECTRIC COMPANY

25 Sixteenth St.

Racine, Wisconsin

Wisconsin Electric Company, 25 16th St., Racine, Wis.

Please send me Free, your latest grinder booklet "1/10,000 of an Inch" and tell me what allowance you will make on the Grinder I have now. This grinder is—

(Insert make and model of Grinder you have on this line)

Name .....

Address .....

City..... State.....



## Diamond Cutting Edges Can't Wear Out

DIAMONDS are unequalled as cutting tools. They cut accurately and at high speed. They can produce a beautiful finish, which, with the complete elimination of lapping and buffing, gives a much closer sliding fit.

A Diamond Tool once set up requires no further attention until the job is finished. *A single tool has run two years on one set-up, turning out thousands of parts with practically no variation.*

And as for economy, time saved in repairing tools and making new set-ups, to say nothing of tool costs and superior finishes, will soon pay dividends on the investment in diamond tools.

You should be using them now.

*Our catalog will gladly be sent on request.*

### Bausch & Lomb Optical Company

662 St. Paul St., Rochester, N. Y.



## *Ability Proved*

Bay State Drills are favorably regarded and widely used everywhere — proof positive of their ability to cut clean, true and fast. Made of tough, resistant steel correctly tempered for rapid work and minimum breakage. A complete range of styles and sizes. Let us send catalogs and prices.

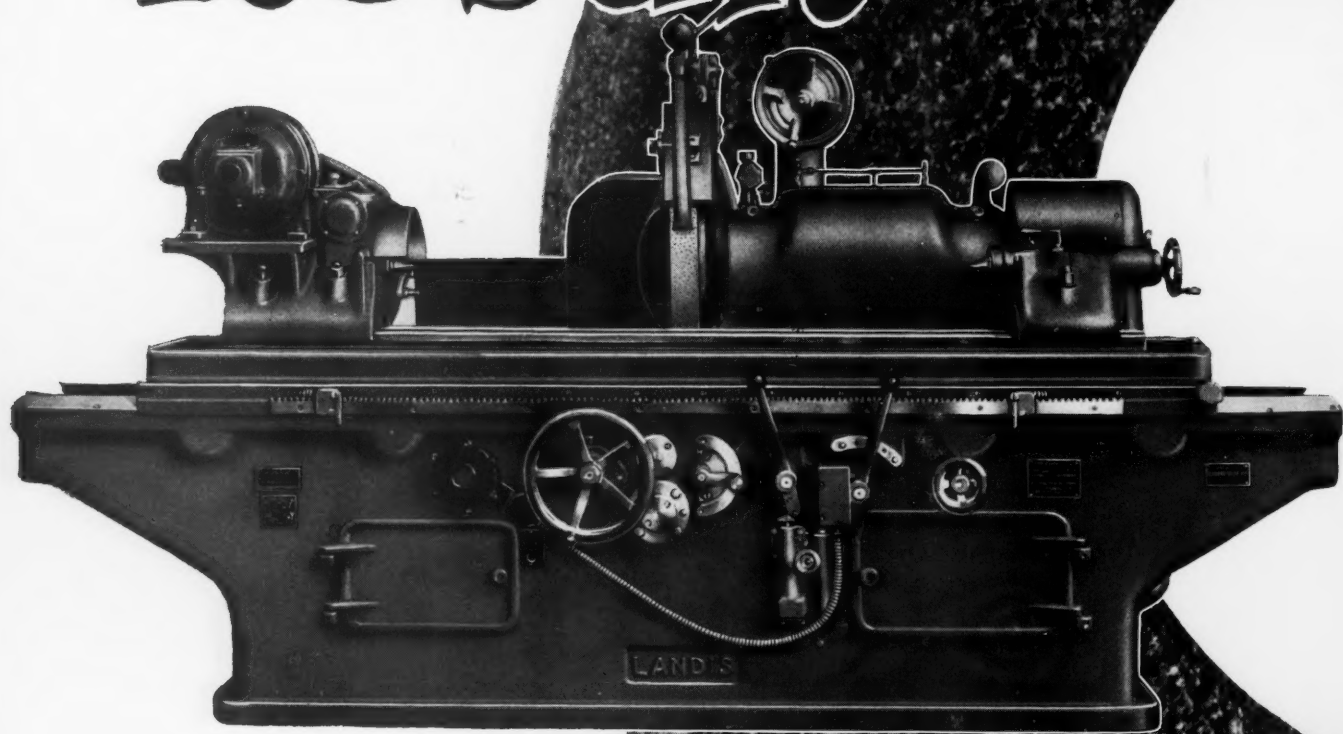
**Bay State Tap & Die Co.**

Mansfield, Mass., U. S. A.

# BAY STATE



# LANDIS GRINDERS Hydraulic Drive Result



**LANDIS**

**LANDIS TOOL COMPANY**

# Large plus Diameter Wheels

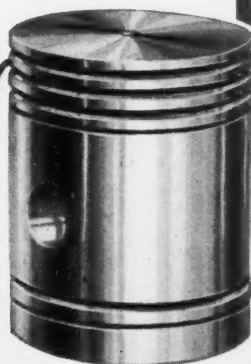
Economical, efficient grinding for almost every metal working plant, with simplified principles of machine operation that have been proved correct by the records which Landis Hydraulics have scored for increased output capacity, decreased maintenance costs and unparalleled accuracy at high rates of production.

There is a Landis Hydraulic Grinder—Standard, Plain, Automatic or Semi-Automatic—that will give accurate, profitable production on your particular type of work.

The samples on this page are but a few of the representative articles upon which Landis Hydraulics have proved themselves.

*The last word in  
Grinding Efficiency*

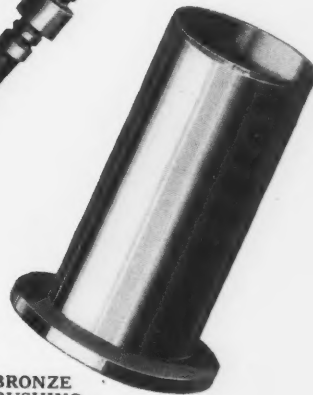
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PISTON



VALVE SLEEVE



BRONZE BUSHING



CRANKSHAFT



DIFFERENTIAL SIDE GEAR

CAMSHAFT



BALL BEARING OUTER RACE

## Track Haulage Problems

present another opportunity for

# Baldwin Steel Roller Chains

to demonstrate their superior qualities. Baldwin specializes in the heavy chains, and where maximum average breaking strengths are required, Baldwin Chains are daily performing in a manner which brings mutual satisfaction to the user and the manufacturer of equipment.



The dependability, strength and wearing qualities of Baldwin Roller Chains are contributing to the success of PLYMOUTH GASOLINE LOCOMOTIVES, manufactured by the Fate-Root-Heath Co., Plymouth, Ohio, to the extent that one enthusiastic user reports his Plymouth Locomotive "doing the work of two of our old steam locomotives."

Baldwin Engineering Service is yours for the asking.

*Catalog "H" will introduce you to Baldwin.*

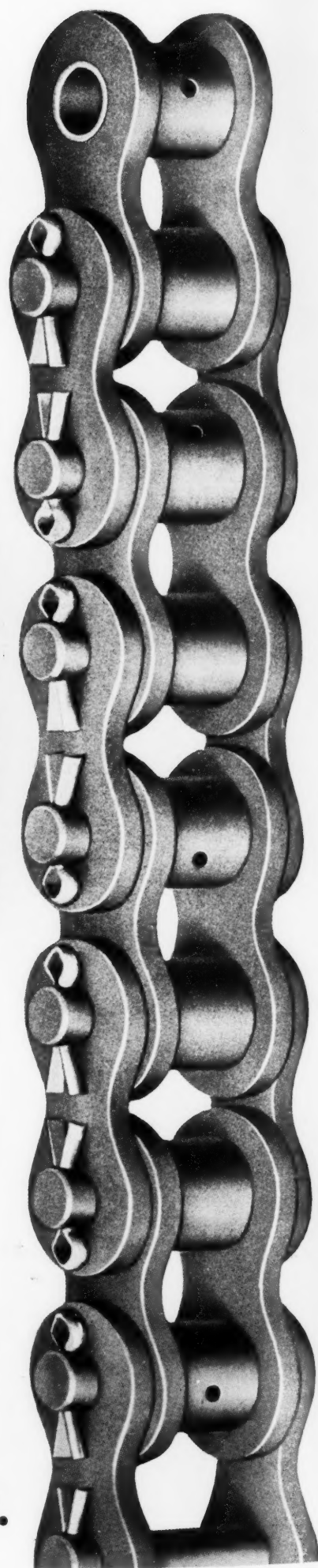
### THE BALDWIN LINE

Steel Roller Chain  
Steel Replacement Chain  
Accurate Sprockets

Precision Silent Chain  
Oil Well Chain  
Special Chains

## BALDWIN CHAIN & MFG. CO.

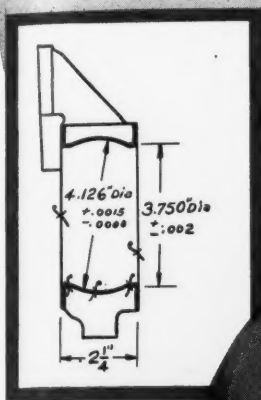
WORCESTER, MASS., U. S. A.





# 5 Minutes

## —Roughing and Finishing Automobile Drive Brackets



The Work



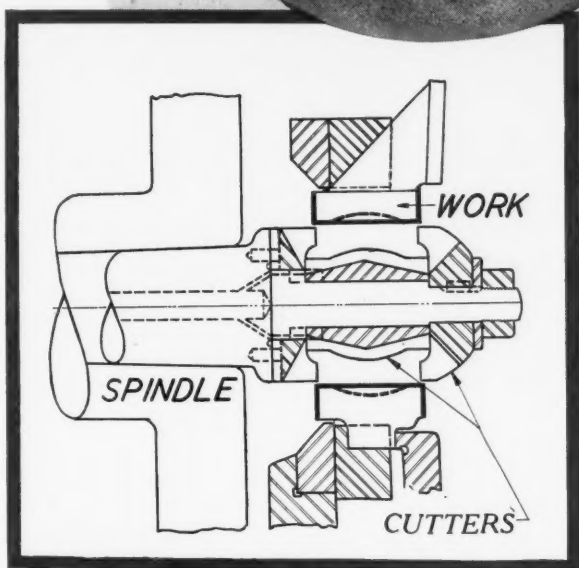
There are two operations:

First—Planamilling *two* faces, the central hole and the spherical ball socket from the rough, removing  $1/16$ " on a side. Time  $2\frac{1}{2}$  minutes floor to floor. Details of this operation are shown in the drawing.

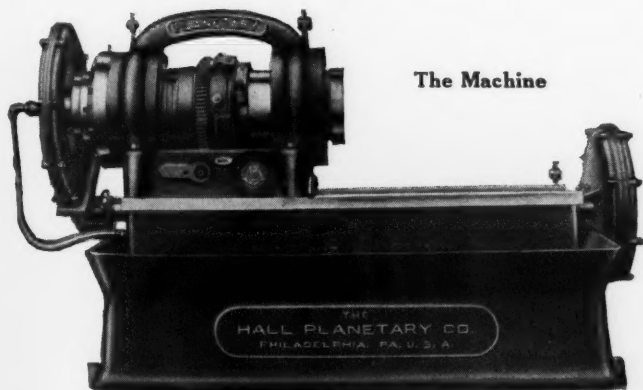
Second—finish Planamilling the spherical ball socket to perfect form. Time  $2\frac{1}{2}$  minutes floor to floor.

We have data like this on a wide range of operations. It is of vital interest and importance to every automotive and many industrial manufacturers.

Send for the Planetary Booklet for details of machine and method. Ask us how to apply them profitably in your plant.



The Method



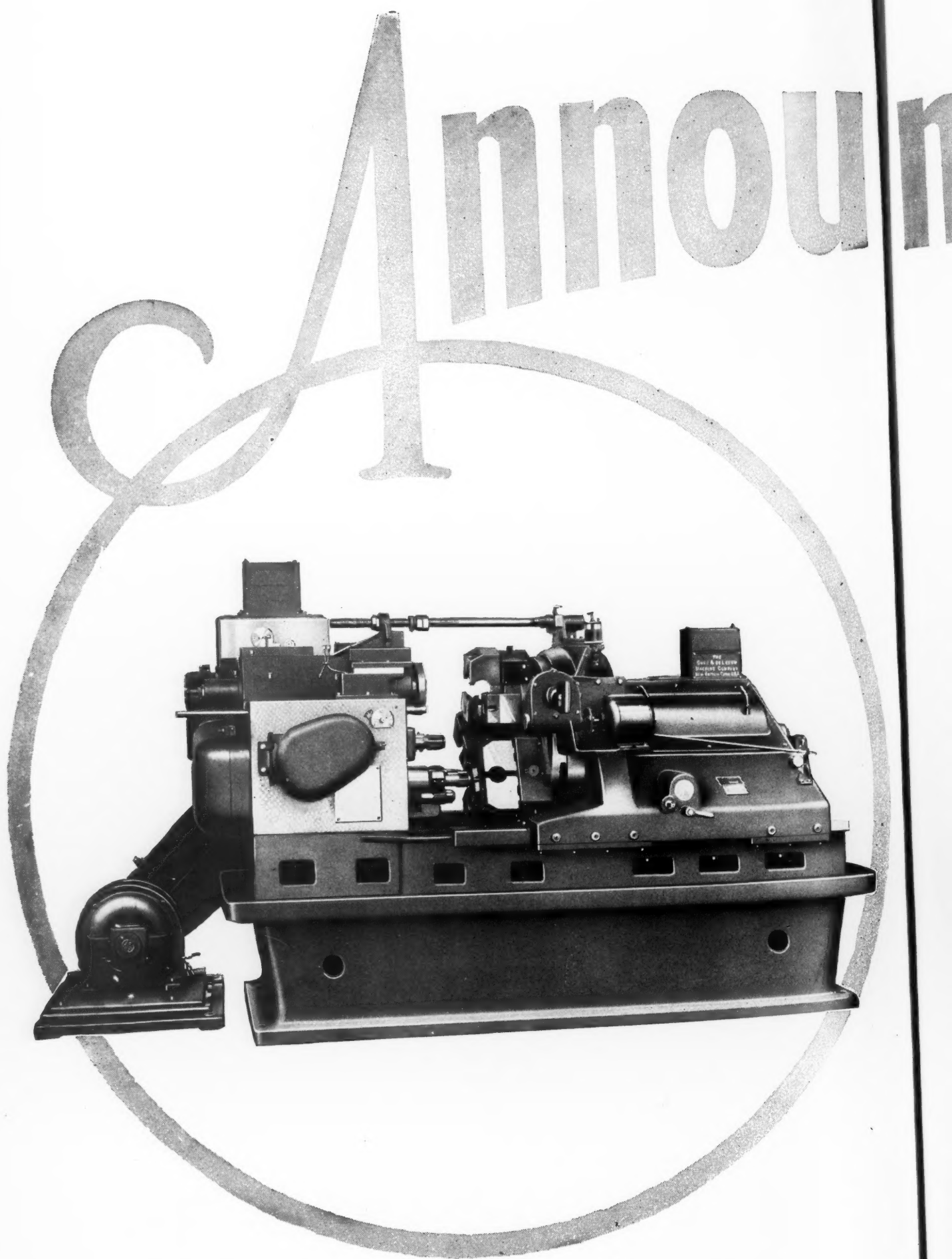
The Machine

**The Hall Planetary Co.**

Fox St. and Abbotsford Ave.  
Philadelphia, Pa.



# PLANAMILLING





## Model B Goss & DE Leeuw Automatic Chucking Machine

... same proved principles of design, same sustained high output, same contributing accuracy ... just a larger model extending the range of work handled to include parts up to 11 in. dia. x 10 in. in length.

Five years ago, the Goss & DE Leeuw Automatic Chucking Machine presented a new and improved method of machining work.

And so effectively did it live up to the claims made for it that it will be found today in every corner of the metal working industry. It was conspicuously more than a good machine—it introduced basic principles of multiple machining that became the standardized method of handling work in several important fields.

Model B is a natural sequence. Where it was possible only to handle parts up to 6-in. dia.

x 6 $\frac{3}{4}$ -in. long, this larger machine extends the range to include work 11-in. in diameter by 10-in. long.

With four sets of tools working on four parts simultaneously, with each spindle individually speeded by change gears to give the top speed for every type of operation and kind of metal, the Goss & DE Leeuw Automatic offers an assured source of lower costs on hundreds of parts now laboriously finished on hand machines. And because of the simplicity of design, these economies can be realized, for the first time, *on small lot schedules*.

Write for illustrated catalog. Better yet, send in prints or specifications for a production estimate.

**The Goss & DE Leeuw Machine Co.**  
NEW BRITAIN, CONN.

AGENTS

Representatives: Henry Prentiss & Company—New York State, Northern New Jersey, Erie, Pa., Connecticut, Massachusetts.

Michigan Representative: J. E. Bullock, 2994 East Grand Blvd., Detroit.

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Cleveland Representative: S. B. Martin, 10612 Clifton Blvd.  
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This booklet contains a series of interesting talks on the more important parts of Shop and Drafting Room Practice—a guide and an outline for the man who has been looking for a systematic plan of enlarging his stock of mechanical knowledge. You can slip this booklet in your pocket and read it at odd moments. It is written in an easy, conversational style.

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# VARIABILITY

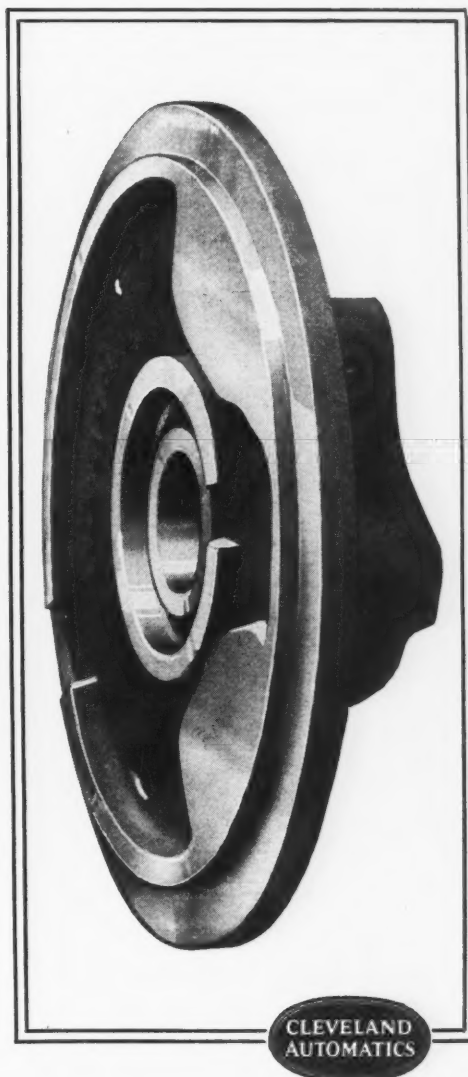
*with Uncompromising*

# PRECISION

THE variability of Cleveland Automatic, Model M 4-Spindle Chucking Machines — with end tools stationary or rotating at independent speeds and with slides operating upon every position — afford the maximum number and variety of cuts consistent with uncompromising precision.

This commutator end plate is a representative job now being produced by a large electrical concern by means of a 4½" Model M Cleveland Chucking machine. Fed by hand to a pneumatic chuck on the upper front position there follows — *lower front*, rough face one-half, counterbore and center; *lower rear*, rough face one-half and drill; *upper rear*, finish face, finish counterbore and bore; *upper front*, ream and load.

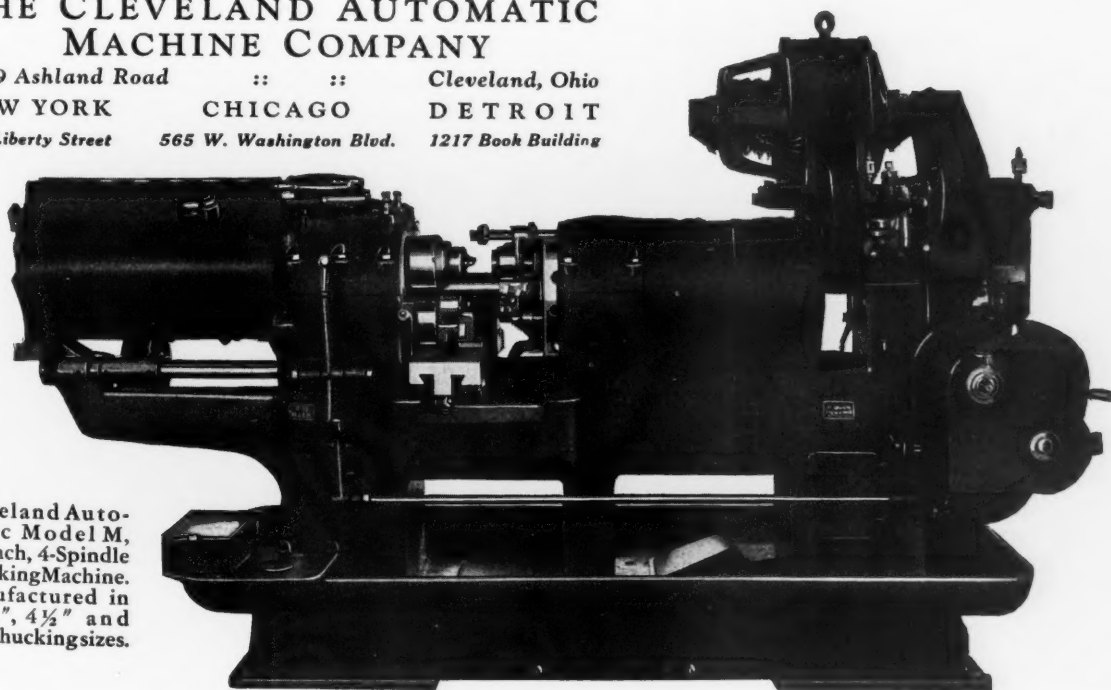
This machine is available either with pneumatic or mechanical chucking control and, on suitable products, magazine feed further reduces the production cost. A new booklet, full of chucking machine suggestions, may bring you just the desired suggestion for your own products.



## THE CLEVELAND AUTOMATIC MACHINE COMPANY

2269 Ashland Road	::	::	Cleveland, Ohio
NEW YORK		CHICAGO	DETROIT
95 Liberty Street		565 W. Washington Blvd.	1217 Book Building

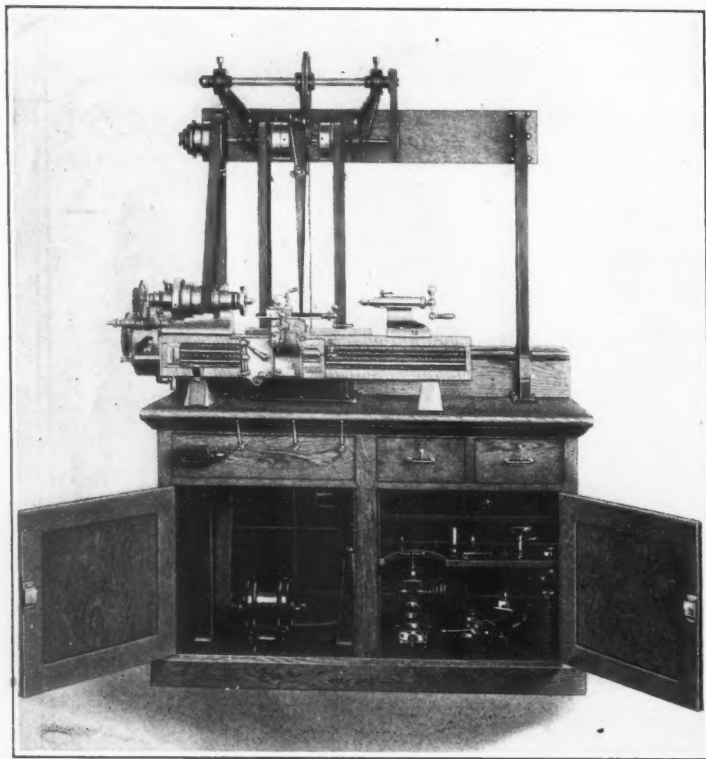
Cleveland Automatic Model M, 4½ Inch, 4-Spindle Chucking Machine. Manufactured in 3", 4", 4½" and 5½" chucking sizes.



# RIVETT

Precision Back-Geared  
Quick Change

# Bench Lathe



The Rivett No. 608 Precision Back-geared Screw Cutting Lathe. The finest product of its kind in the world—designed and built by masters of the art of toolmaking—accurate, versatile, long lived.

*Send for a copy of the catalog  
No. 608-A*

**Rivett Lathe and Grinder  
Corporation**

Brighton District of Boston, Mass., U.S.A.

**"IF IT'S RIVETT—IT'S RIGHT"**

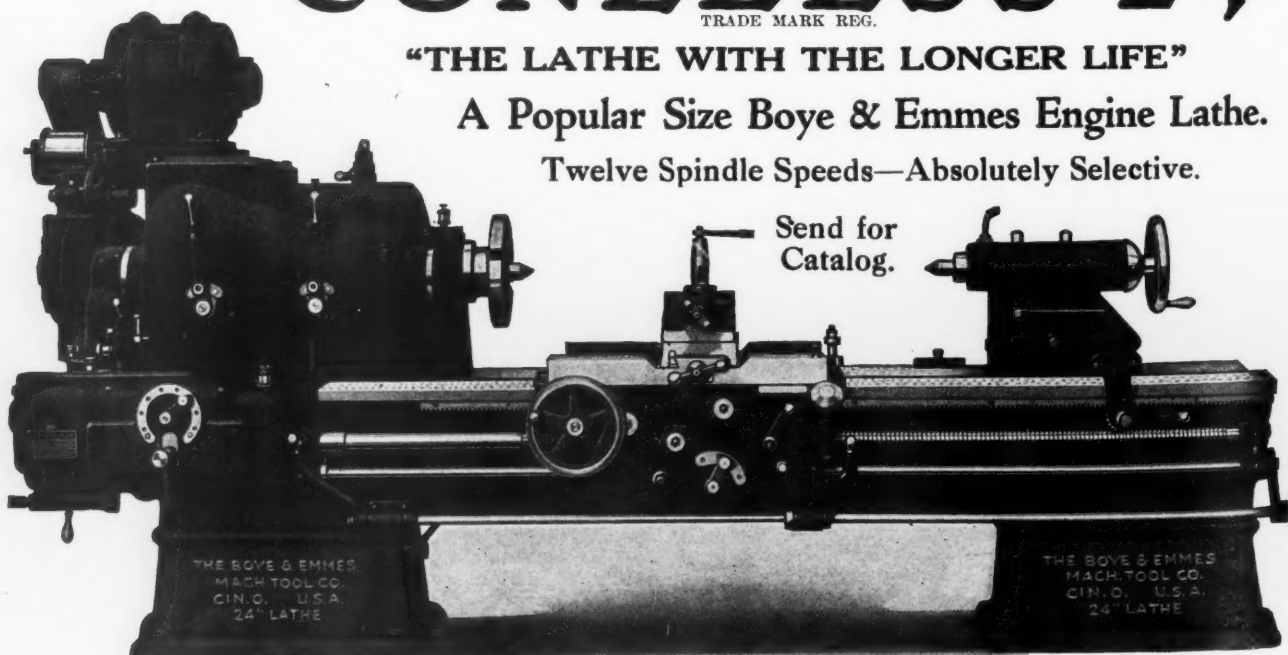
## CONELESS 24"

TRADE MARK REG.

**"THE LATHE WITH THE LONGER LIFE"**

**A Popular Size Boye & Emmes Engine Lathe.**

**Twelve Spindle Speeds—Absolutely Selective.**



**Send for  
Catalog.**

**The Boye & Emmes Machine Tool Co., Cincinnati, Ohio, U. S. A.**

**Selling Agents:**

**NILES-BEMENT-POND COMPANY**, New York, 111 Broadway; Birmingham, 28 So. 20th St.; Boston, 75 Batterymarch St.; Chicago, 564 W. Monroe St.; Cincinnati, 338 W. 4th St.; Los Angeles, 454 E. 3rd St.; Philadelphia, 2415 Chestnut St.; Pittsburgh, 1115 Empire Bldg.; Rochester, 89 East Ave.; St. Louis, 1909 Washington Ave.; San Francisco, 917 Howard St.

**THE STRONG, CARLISLE & HAMMOND CO.**, 1392 W. 3rd St., Cleveland, O., 1300 Fort St., West, Detroit, Mich.



# 3 NEW CISCO FEATURES

## 1 Ball Bearing Spindle

The CISCO Ball Bearing Spindle Mounting reduces friction in the headstock to a minimum. This enables lathes to take heavier cuts than heretofore. This mounting is standard, and is guaranteed to be as accurate as plain bearing types.

## 2 Centralized Lubrication

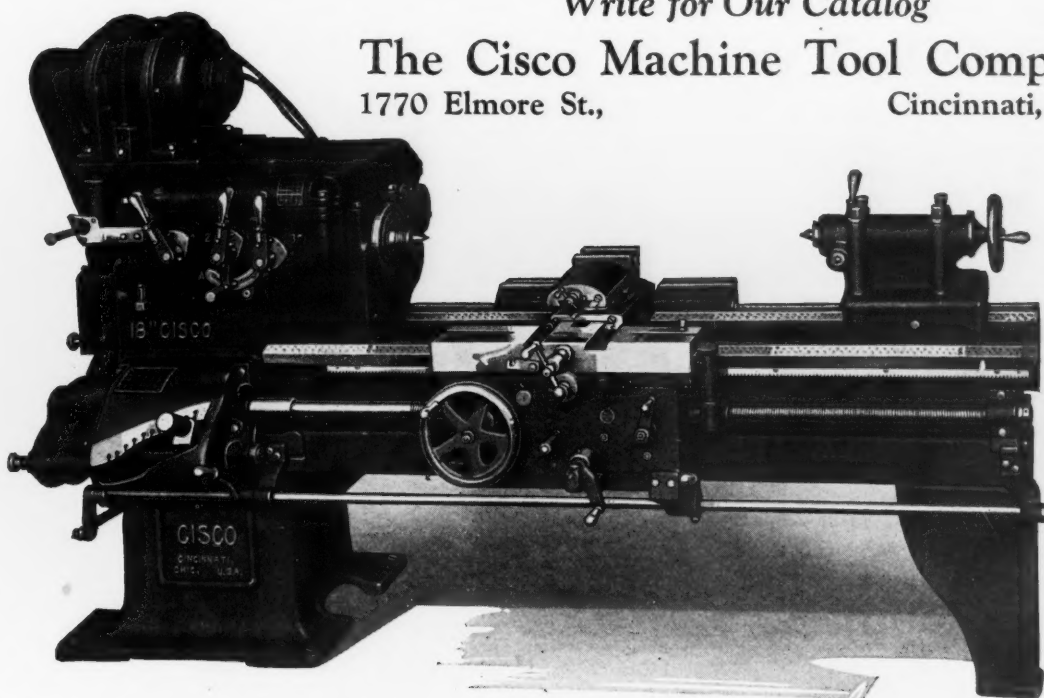
A Bowen "One-Shot" Lubrication system for oiling the gear box, feed box, reverse plate, and lead screw bearing has been adopted as standard equipment. This eliminates the costly "Oil Can" method, and insures ample lubrication of these parts.

## 3 Double Nose Spindle

The Double Nose Spindle is a standard feature which insures better alignment of chucks and face plates. This feature increases the accuracy of the lathe, and allows the operator to work to closer limits.

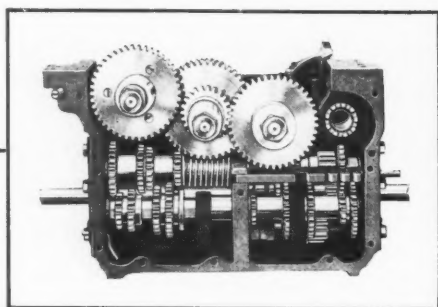
*Write for Our Catalog*

**The Cisco Machine Tool Company**  
1770 Elmore St., Cincinnati, Ohio



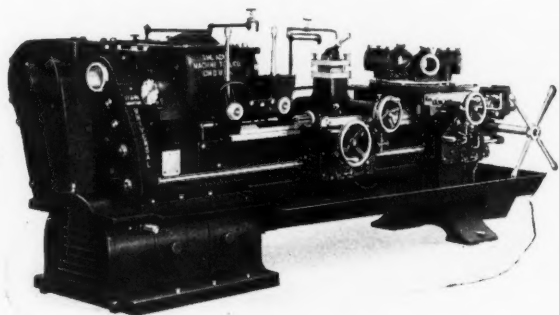
LATHES   RADIALS   POLISHING MACHINES   TAPPING MACHINES

**THE APRONS  
OF ALL SIZES  
DUO CONTROL  
ACME TURRET LATHES  
ARE EQUIPPED WITH  
BALL BEARINGS**



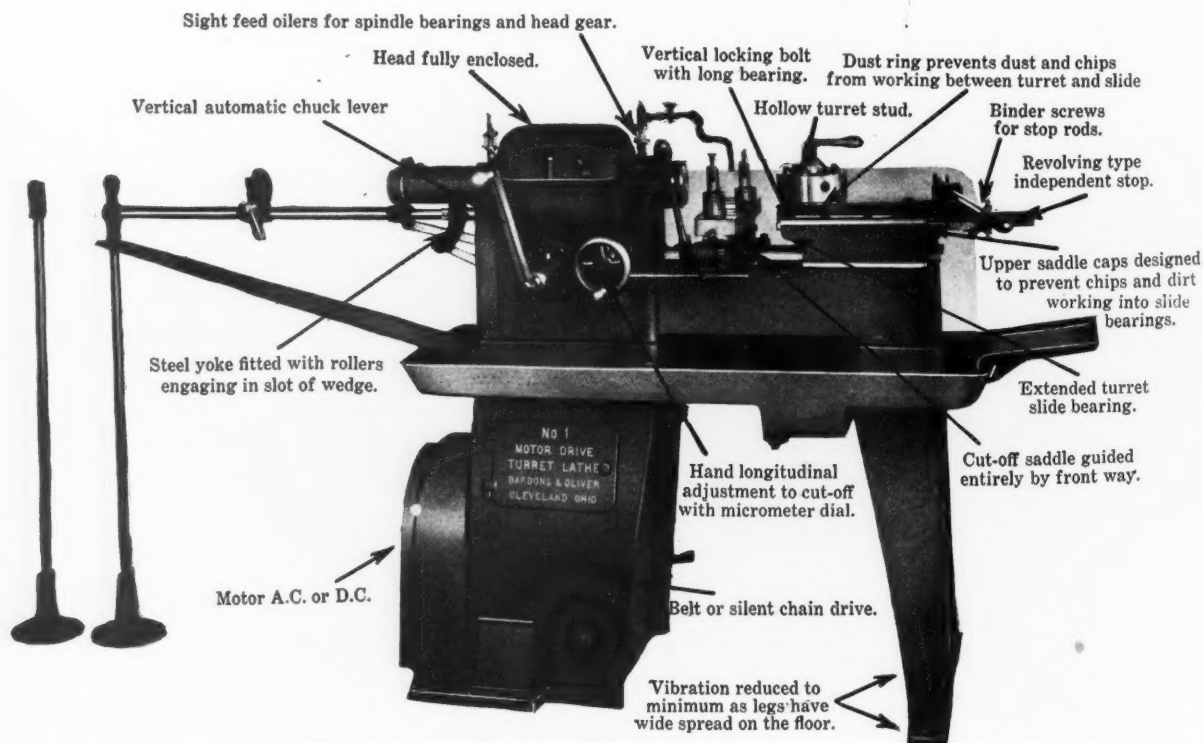
**E**ASE of control is an outstanding feature in the design of these duo control aprons.

Twelve independent forward and reverse feed changes are obtained for cross and longitudinal motions. All changes are made through sliding gears—heat treated and oil hardened—mounted on square shafts which revolve in ball bearings.



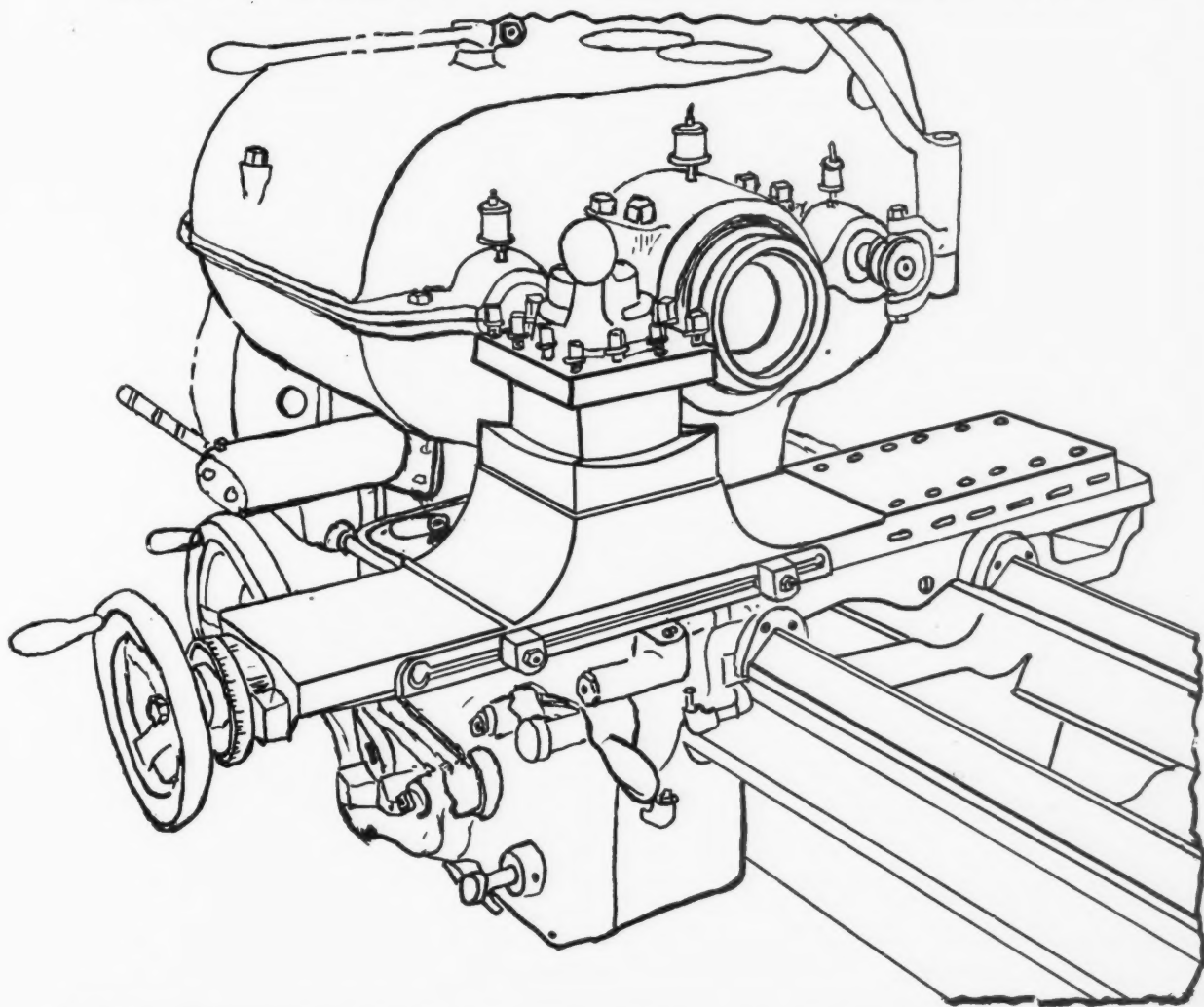
**The Acme Machine Tool Company  
4955 Spring Grove Ave., Cincinnati, Ohio**

**A New Line of Motor Driven Turret Lathes  
Well Adapted for Production Work**



**BARDONS & OLIVER, 1133 West Ninth St., Cleveland, O.**

Just a Sketch—  
To Show You—  
The Bridge Type—  
Cross Slide—  
Used on ***FOSTER***  
Universal Turret Lathes

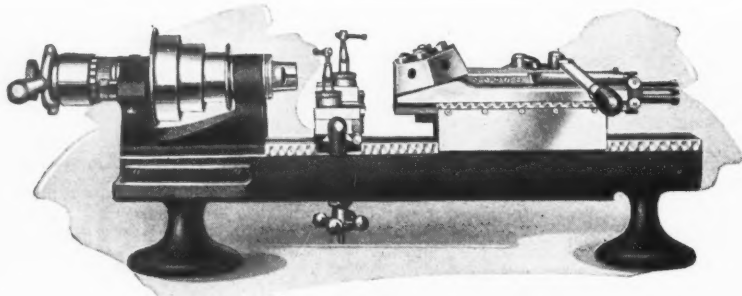


**E**VERY machine should be considered from the net earning power of the investment. The bridge type cross slide, doubly supported by the bed is an investment feature leading to high earning power with Foster Universal Turret Lathes. With the additional convenient possibility of mounting tooling back of the work on the rear of the cross slide, difficult turning jobs are simplified and tooling costs reduced. Many other features equal in advantage from the investment standpoint are also available to the purchaser of Foster Universal Turret Lathes.

Samples or blue prints of your work will enable us to give you Foster figures.

**FOSTER MACHINE COMPANY**  
ELKHART, INDIANA





*Cataract*

Bench Lathes  
Precision Lathes  
Millers, Attachments

Write for Catalogue

HARDINGE BROTHERS, Inc., 4149 Ravenswood Avenue, Chicago

## Completely Equipped



A Davis Keyseater, a set of Davis Keyseat Cutters ranging from 1/16" to 1" in sixteenths and some thirty-seconds, provide complete equipment for the keyseating operations that come up in the average shop.

The "two-minute set-up," a Davis feature, insures rapid production on manufacturing or special work.

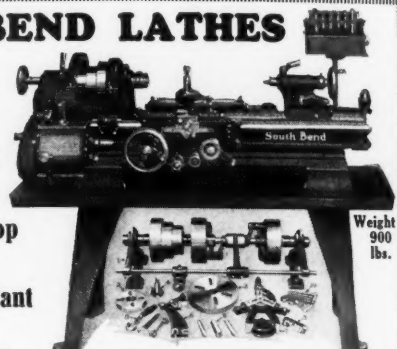
Send for details of Davis Keyseating Equipment and Keyseat Cutters and Broaches in H. S. and Carbon Steels.

**Davis Keyseater Company**  
255 Mill Street, ROCHESTER, N. Y.

## SOUTH BEND LATHES

for the

Tool Room  
Machine Shop  
Laboratory  
Engineering Shop  
and  
Manufacturing Plant



Weight  
900  
lbs.

Write for New  
Catalog showing 210  
styles and sizes  
of Lathes

11' x 4' New Model Back  
Geared Screw Cutting Tool  
Room Precision Lathe **\$335**

**SOUTH BEND LATHE WORKS** 789 E. Madison Street  
SOUTH BEND, INDIANA, U. S. A.  
New York City: J. E. Boggs Co., 183 Centre Street

## FLATHER LATHES

HIGHEST GRADE FOR TOOL-ROOM  
AND MANUFACTURING PURPOSES

The Flather Company, Nashua, N. H.

Steinle Turret Machine Co.

THE FULL SWING SIDE CARRIAGE  
TURRET LATHE

STEINLE TURRET MACHINE CO.  
MADISON WISCONSIN U. S. A.



## Teer-Wickwire Automatic Burr Cutter

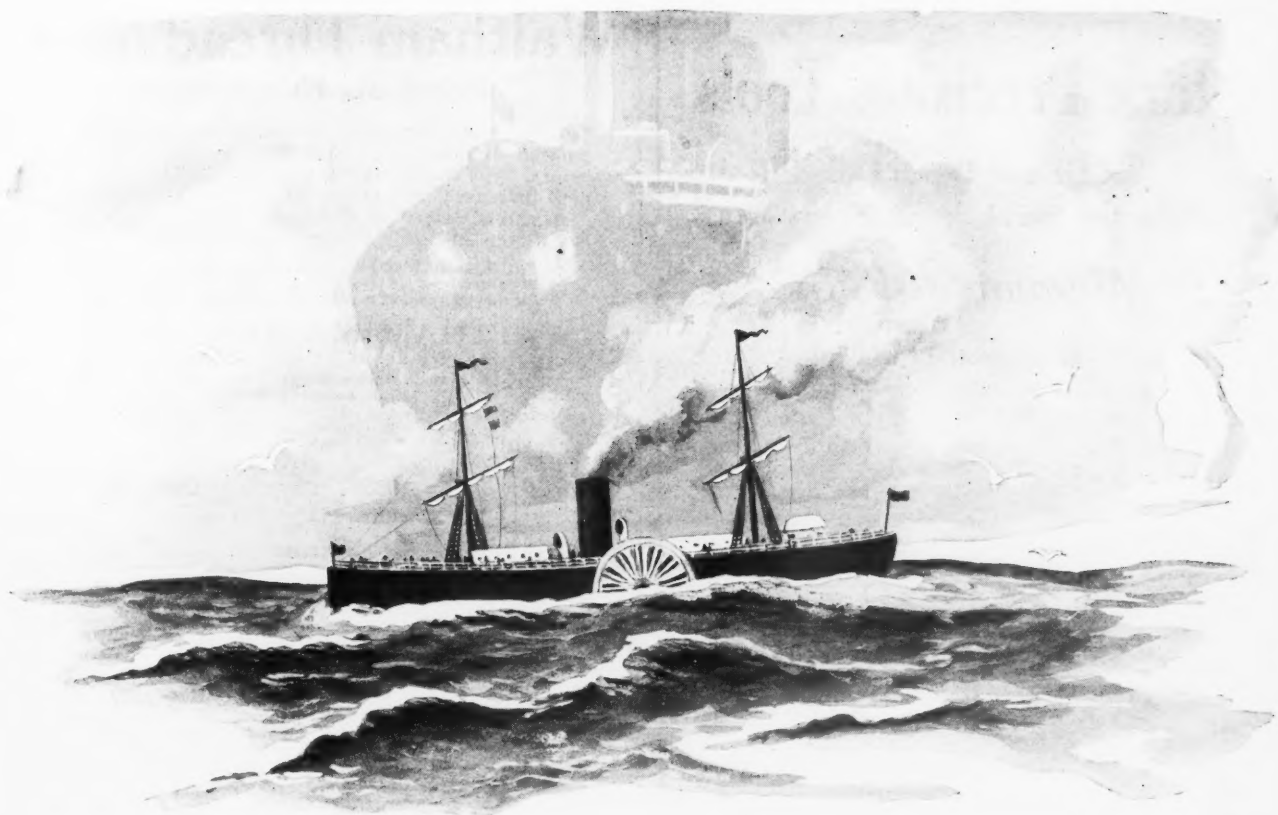
Burrs cap screws at a labor cost of less than 2 cents per thousand instead of 20 to 35 cents per thousand—the average cost on the snagging wheel.

A money saver on such important quantity production as Milled Cap Screws and similar automatic parts.

**TEER, WICKWIRE & CO.**  
JACKSON, MICHIGAN, U. S. A.

Range from 1/4" to  
5/8" diameter—  
Send for details.





# Four weeks... *or* 100 hours!

A recent shipping report announced the launching at Hull, England, of a giant liner capable of crossing the Atlantic in 4½ days! Yet it wasn't so many years ago that people were acclaiming the feat of the "Queen of the Atlantic" for making the crossing in 28 days!

The modern age clamors for the spectacular in speed and efficiency. But it is the slow, constant, determined effort—tireless devotion to a cause, that at times seems hopeless—which makes possible the accomplishments which the world acclaim! In this background of research and develop-

ment, an important niche is filled by the engineers who are designing and building the production machinery which has made these modern methods of transportation practical realities.

It is this sort of enthusiasm which has inspired Walcott engineers in developing a line of automatic crankshaft and cam-turning lathes which perform three operations where one was done before—machines possessing so high a degree of efficiency that each Walcott is actually replacing six lathes, which but a few years ago were the most modern type available.

*Walcott Builds: Gear Grinders, Camshaft  
Lathes and Crankshaft Contour Lathes*

**WALCOTT MACHINE CO.**

Jackson, Michigan

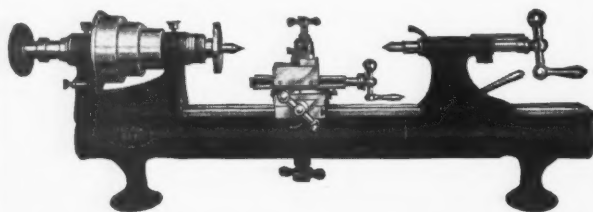
# Walcott

## Stark Precision Tools

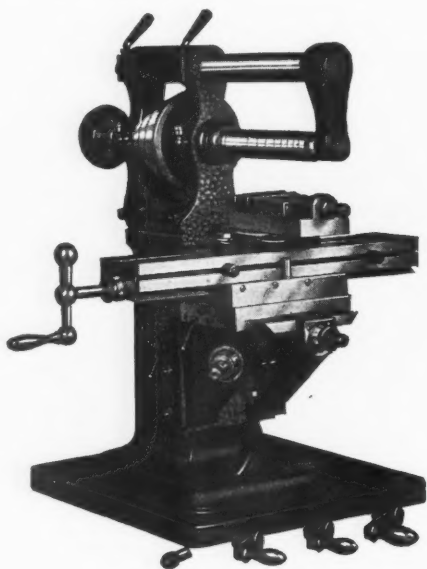
Six Sizes of Bench Lathes  
Plain and Spiral Bench Millers are

### *Micrometer-Built*

From the first machining operation to the final inspection all essential parts are held to split-thousandth limits to meet the increasing demand for tools of unusual accuracy.



Consequently, Stark lathes and millers may be depended upon for long service on exacting work which they can handle far more rapidly and efficiently than any other tools. Records of twenty years of continuous service are not unusual.



Manufacturers of meters, clocks, carburetors, optical devices, aircraft navigating instruments and motor cars are using Stark equipment for fine production and tool room work.

Let us show you what they will do on work of this class.

### Stark Tool Company

Waltham, Mass.

Established 1862

*Originators of American Bench Lathe*

## Waltham Thread Miller Pays on Production

The improved Waltham Thread Miller combines production and accuracy to a greater degree than ever before. The incorporation of a number of new features has increased its range and earning capacity immeasurably, but it is still semi-automatic and can be run at top efficiency by an unskilled operator.

*Put the new Waltham on your threading work up to 2" diameter. It will give you an entirely new conception of general proficiency. Circular on request.*

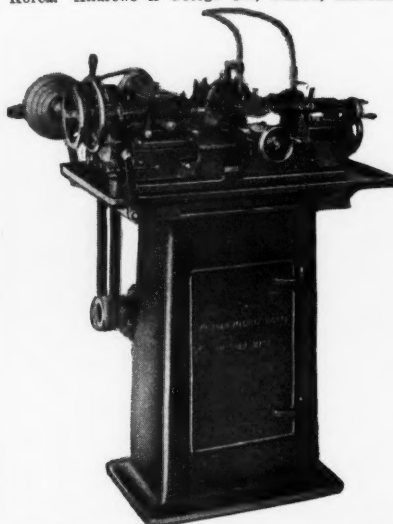
### WALTHAM MACHINE WORKS

NEWTON STREET

WALTHAM, MASS.

Makers of Small Thread Millers, Gear Cutters, and other Small Automatic Machines

Foreign Representatives: Buck & Hickman, Ltd., London. Fenwick Freres Co., Paris. Andrews & George Co., Tokyo, Japan. Andrews & George Co., Seoul, Korea. Andrews & George Co., Dairen, Manchuria.

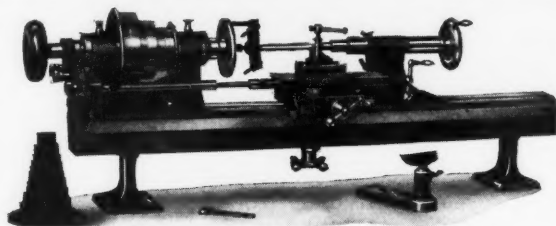


### FEATURES

New method of oil and chip disposal permits greater supply of coolant; new and improved mechanism for relieving taps and multiple cutters; special cutter-head for external and internal milling; special cutter-head for helix angles of 40° or more.

**WALTHAM**  
TRADE MARK  
REGISTERED U.S. PAT. OFF.

For External or  
Internal Threading  
on Small Parts

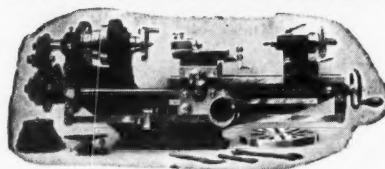


### Almost a Complete Machine Shop

An Elgin Precision Bench Lathe with attachments is capable of turning, boring, drilling, milling, sawing, slotting, shaping, grinding, etc. Excels larger tools on production, is unexcelled for precision. Details on request.

ELGIN TOOL WORKS, Inc. ELGIN, ILLINOIS

## The DRUMMOND BENCH LATHE



7" Swing  
9" in Gap  
1 1/4" or 2 1/4"  
between Centers

This well tried lathe is more than a "turning machine," for it enables you to mill, drill, face, saw, bore and do dozens of operations besides all ordinary turning and screw cutting. Strong, rigid and heavy cutting yet working to fine limits with certainty.

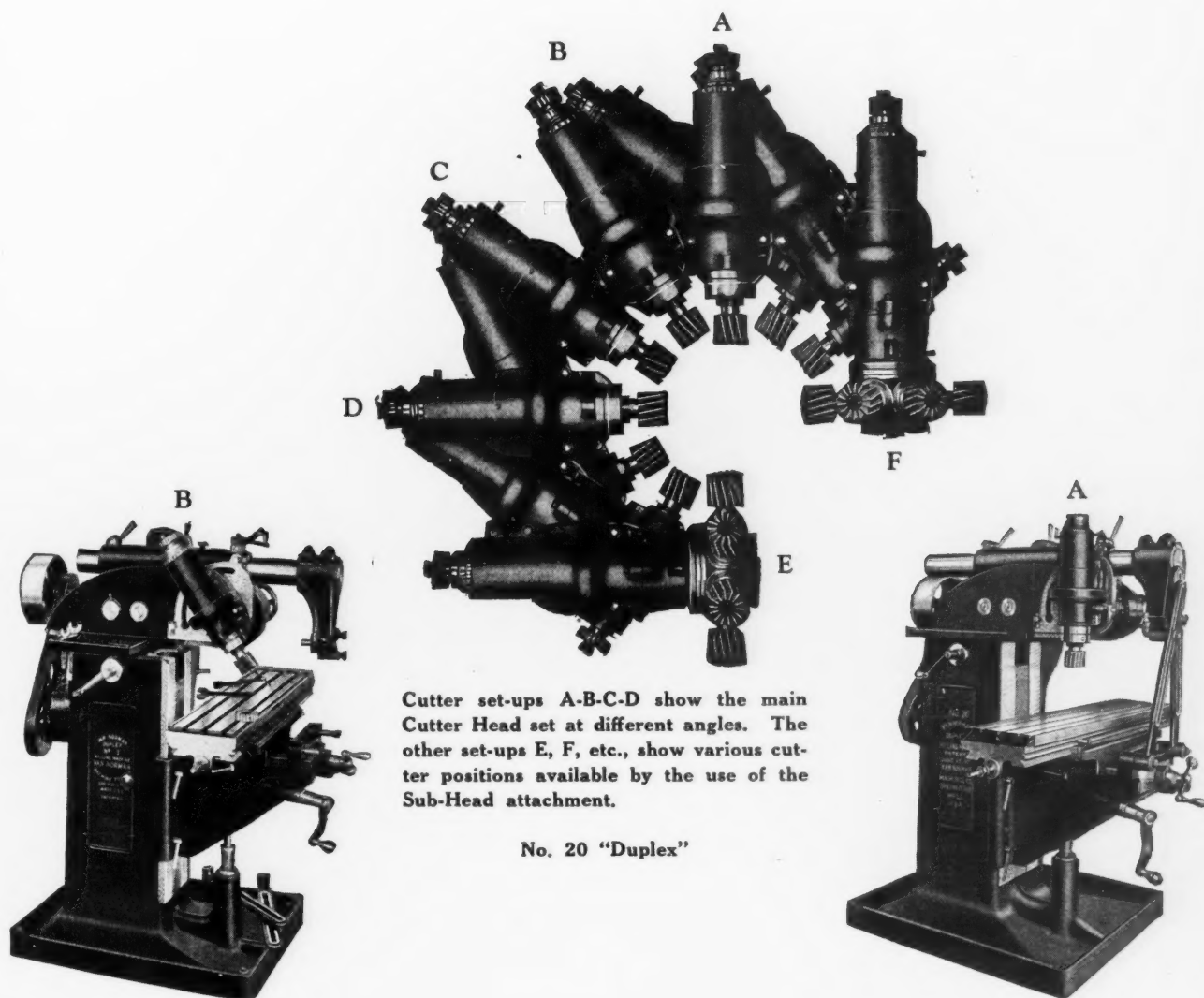
See all details in catalog 7

### THE GEROLD COMPANY

120 Liberty Street

New York, N. Y.





Cutter set-ups A-B-C-D show the main Cutter Head set at different angles. The other set-ups E, F, etc., show various cutter positions available by the use of the Sub-Head attachment.

No. 20 "Duplex"

**T**HE Cutter Head is pivotally mounted on a horizontally slidable ram. These special features give to the Van Norman "Duplex" a maximum range and adaptability — with rapid change set-ups for many different cutting operations.

Users pronounce this miller to be not only the most completely universal milling machine for general utility and tool room purposes—but also *a real time and money saver.*

(Built in 5 Sizes)

**Van Norman**  
machine tool co.  
SPRINGFIELD ~ ~ ~ ~ MASS.

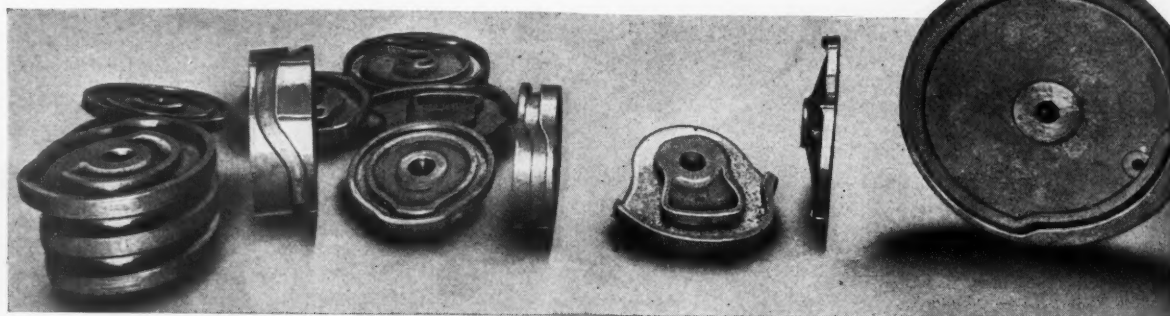
# Rowbottom for Cams

The production method established by Rowbottom Cam Milling machines insures speed, accuracy and economy in cam production.

Standard model machines take care of box cams to 32" outside diameter, face cams to 28", barrel cams to 24" with 11" throw; slight

changes make them ready for practically any size or type of cam.

Try "Rowbottom for Cams"—placing your orders in our cam cutting contract shop or installing Rowbottom Cam Milling Machines in your plant. Send for details and estimates.



**THE ROWBOTTOM MACHINE CO.**  
**WATERBURY** (Factory: Waterville, Conn.) **CONNECTICUT**



## **WICAGO** CONTINUOUS OIL GROOVER

is unequalled for production and quality in cutting oil grooves—straight, cross, right-hand or left-hand helical on external or internal surfaces; and for

**Honing Internal Holes**  
 to .0001 smoothness\* for electrical refrigeration pumps, etc.

\*Due to the fact that the hone never follows its previous path but is constantly crossing it.

Send our engineers samples of what you want and let us show you, by actual test, how the Wicaco will increase your production and lower the unit cost.

**Marvellous Speed of Production**

## **WICAGO**

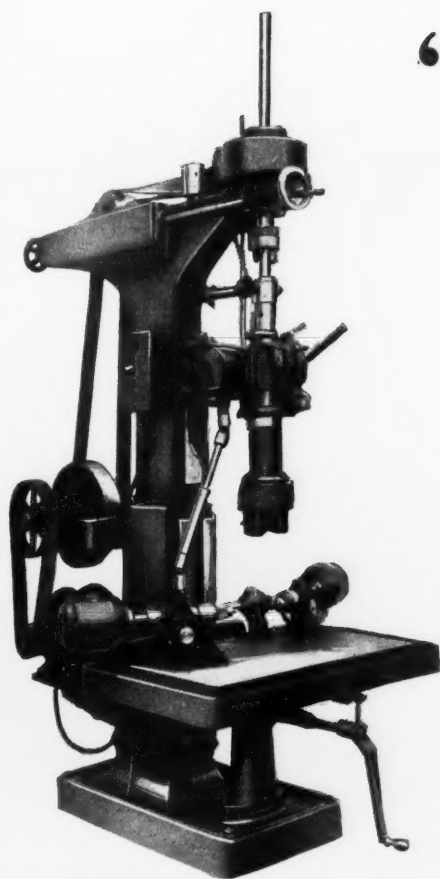
**Screw & Machine Works, Inc.**

Stenton Ave. and **PHILADELPHIA** Wayne Junction  
 Louden Street P. & R. R. R.  
Established in 1868—59 years of continuous production

**RAYON PUMPS AND EQUIPMENT**

# "Specially Built"

## Drilling Service from Standard Units



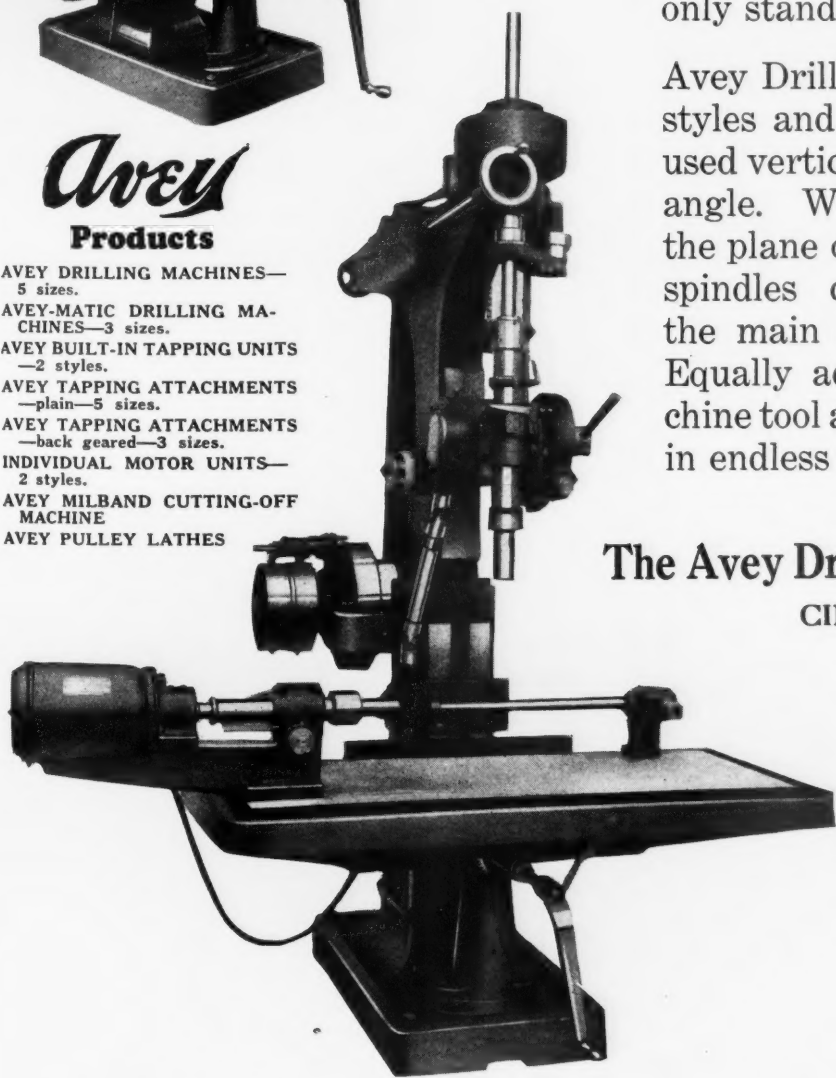
**Avey**  
Products

AVEY DRILLING MACHINES—  
5 sizes.  
AVEY-MATIC DRILLING MA-  
CHINES—3 sizes.  
AVEY BUILT-IN TAPPING UNITS  
—2 styles.  
AVEY TAPPING ATTACHMENTS  
—plain—5 sizes.  
AVEY TAPPING ATTACHMENTS  
—back geared—3 sizes.  
INDIVIDUAL MOTOR UNITS—  
2 styles.  
AVEY MILBAND CUTTING-OFF  
MACHINE  
AVEY PULLEY LATHES

The efficiency of the single purpose machine for rapid and economical production is recognized everywhere—Avey Motor Driven Drilling Units make it possible to convert a standard Avey Drilling Machine into a special purpose drill, convertible to new uses as often as desired, and employing only standard units.

Avey Drilling Units, built in two styles and several sizes, may be used vertical, horizontal or at any angle. With them holes out of the plane of the drilling machine spindles can be drilled while the main spindles are working. Equally adaptable to other machine tool applications, and usable in endless combinations.

**The Avey Drilling Machine Co., Inc.**  
CINCINNATI, OHIO



*A new Bulletin  
shows several inter-  
esting installations  
and gives details of  
sizes, models, etc. Let  
us put a copy in the  
mail for you.*

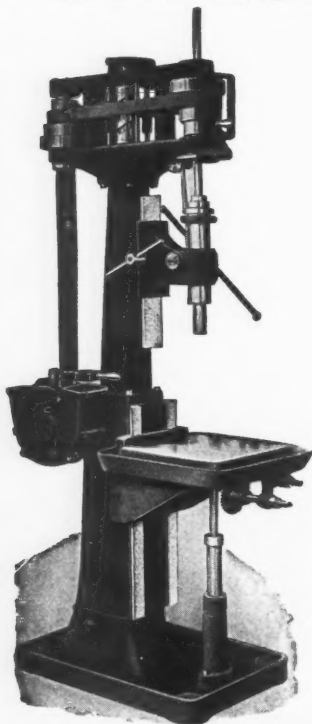
**Avey**

MOTOR  
DRIVEN

# Drilling Units



# FOSDICK DRILLING MACHINES



With more than 32 years' experience building drilling equipment *exclusively* to draw upon, Fosdick Drilling Machines possess refinements in design and construction which set new standards for performance and reliability.

The Fosdick Line is complete and offers a machine to handle the work of any shop.

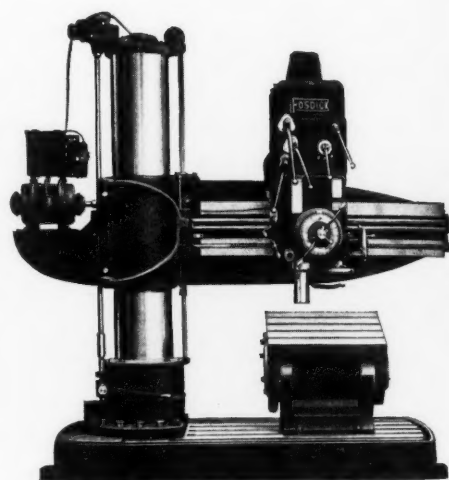
**RADIALS**—Wide range of speeds and feeds—hardened alloy steel gears. 3—7 ft. models have constant speed motor on arm. 3—7 ft. models: capacity 3/16" to 4" drills.

**HIGH SPEED SENSITIVES**—3, 3 1/2, 4 ft. for drilling and tapping, capacity to 1".

**UPRIGHTS**—21" to 30". Capacity 3/16" to 3".

**BALL BEARING SENSITIVES**—13" to 24", 1 to 6 spindles, capacity to 1 1/8".

Write for Details



**THE FOSDICK MACHINE TOOL CO., Cincinnati, Ohio, U.S.A.**

**AGENTS:** Colcord-Wright Machinery & Supply Co., St. Louis, Mo. Barbour, Love & Woodward, New York, N. Y. E. A. Kinsey Co., Cincinnati, Ohio, Indianapolis, Ind. Peninsular Machinery Co., Detroit, Mich. Homer, Strong Co., Rochester, N. Y. Buffalo, N. Y. H. A. Smith Machinery Co., Syracuse, N. Y. Swind Machinery Co., Philadelphia, Pa. Somers, Fidler & Todd Co., Pittsburgh, Pa. Stocker-Rumely-Wachs Co., Chicago, Ill. Milwaukee, Wis. Brownell Mch. Co., Providence, R. I. The Mine & Smelter Supply Co., Salt Lake City, Utah. Moore-Handley Hardware Co., Birmingham, Ala. C. F. Bulotti Mch. Co., San Francisco, Cal. Eccles & Davies, Los Angeles, Cal. Bay Verte Mch. Supply Co., Green Bay, Wis. M. A. Wertman Mch. Co., Cleveland, O. Brazelton, Wessendorf & Nelms, Houston, Texas. Burton, Griffiths & Co., London, England. Fenwick Freres Co., Paris, France. Wynmalen & Hausman, Rotterdam, Holland. Rylander & Asplund, Stockholm, Sweden.

## Drills and Removes Burrs

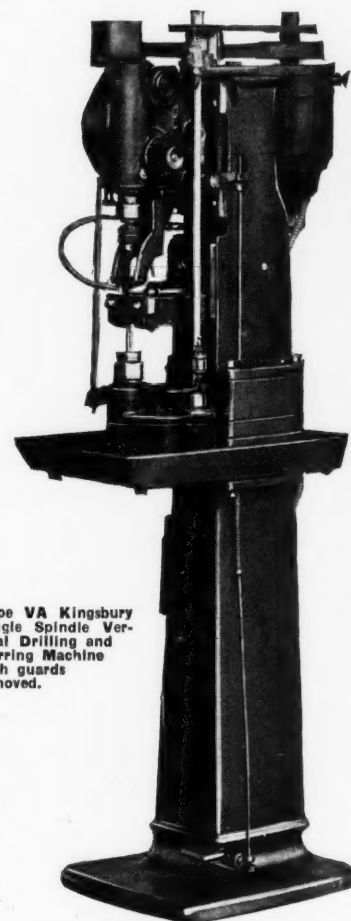
This Kingsbury Single Spindle Semi-automatic Drilling Machine is equipped with an underneath spindle which automatically removes the burr left by the drill. This machine is also equipped with an automatic clamping and ejecting fixture.

Kingsbury Automatic Drilling and Tapping Machines can be furnished in an unlimited number of types for production work.

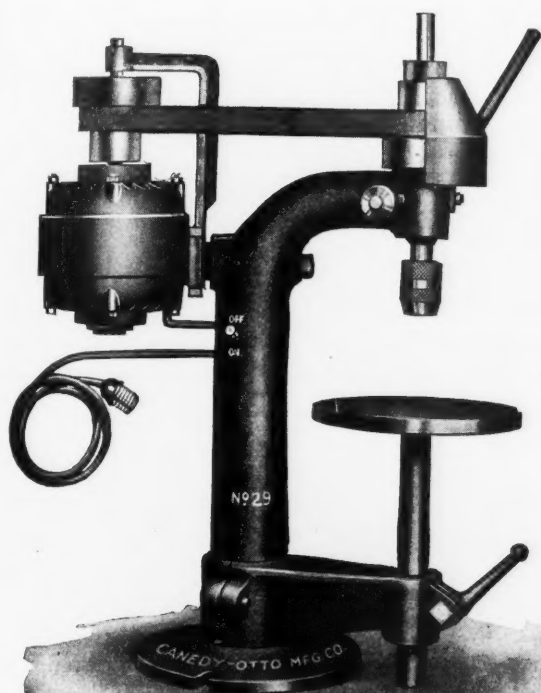
**Kingsbury Machine Tool Corp.**

**KEENE, N. H.**

*Originators of the Automatic Drill Head Unit*



Type VA Kingsbury Single Spindle Vertical Drilling and Burring Machine with guards removed.



## Popular—and with reason!

Canedy-Otto Drilling Machines are quality equipment, economically priced. The line is large, the range wide. There's a drill for every need and the efficiency of each machine is good reason for the fact that C-O Drilling Machines are standard equipment in many well known plants.

### C-O No. 29 Sensitive Bench Drill

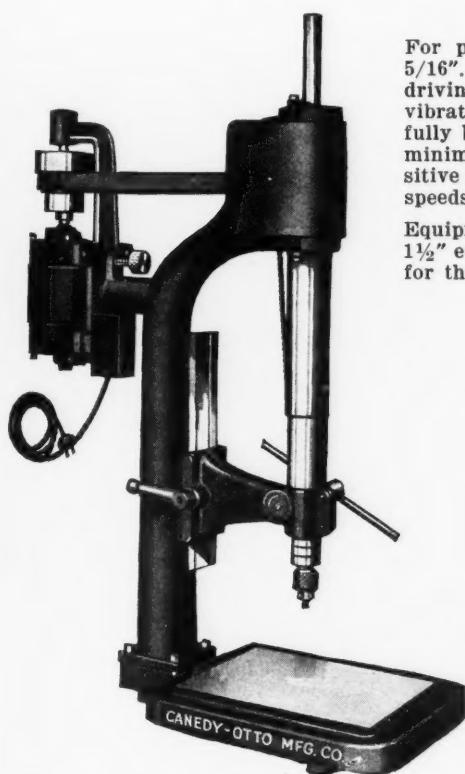
Gearless, noiseless, vibrationless; capacity 0 to  $\frac{3}{8}$ "; drills to center of 10" circle. Equipped with  $\frac{1}{4}$  H.P. Vertical Type Ball Bearing Motor easily adjustable to secure proper belt tension. Accurately ground spindle equipped with ball thrust bearing and chuck fitted to run true; spindle speeds 720-1430-3000 R.P.M.

Shipped complete with leather belt and chuck, toggle type switch extension cord and socket "Ready for the Job"—just connect and put to work.

### C-O 14" High Speed Sliding Head Sensitive Drill

For precision production on holes from 0 to  $\frac{5}{16}$ ". Vertical type motor greatly simplifies driving mechanism and practically eliminates vibration. High grade ball bearings and carefully balanced construction reduce friction to a minimum. Counter-balanced spindle gives sensitive and uniform action to feed pinion: Spindle speeds 3400, 5600, 10,000 R.P.M.

Equipment includes toggle switch and cord, and  $1\frac{1}{2}$ " endless belt—attached. In fact it is "Ready for the Job"—ready to operate *when delivered*.

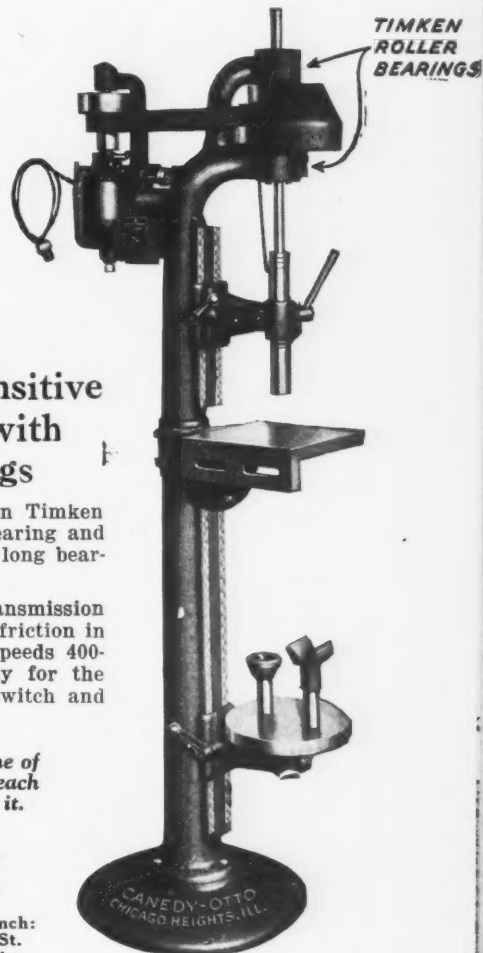


### C-O 14" Sliding Head Sensitive Floor Drill—Equipped with Timken Roller Bearings

Capacity 0 to  $\frac{1}{2}$ "; cone pulley operates on Timken Roller Bearings, spindle has ball thrust bearing and is amply supported by a sleeve with extra long bearing.

Vertical motor eliminates much power transmission equipment (idlers, pulleys, etc.), reducing friction in operation, halving power costs. Spindle speeds 400-850-1750 R.P.M. Shipped complete "Ready for the Job"—plug in the cord, turn the toggle switch and you're ready to go.

Send for details of the Canedy-Otto line of production drilling machines; note that each is "Ready for the Job"—and equal to it.



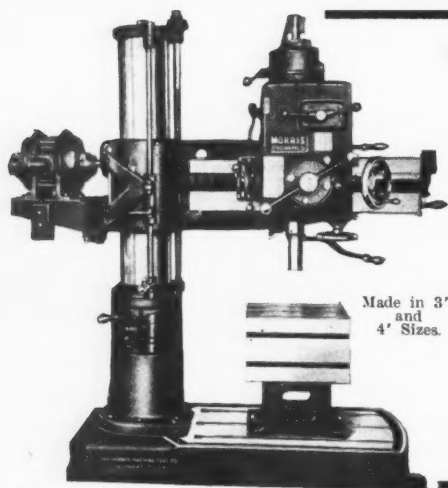
## CANEDY-OTTO MFG. COMPANY

San Francisco Branch  
955 Folsom St.  
San Francisco, Cal.

CHICAGO HEIGHTS, ILL.

Complete Stock Carried at All Branch Offices

New York Branch:  
407 Broome St.  
New York City.



Made in 3' and 4' Sizes.

## "MOR-SPEED"—and we mean it!

The new Morris Radial was named "Mor-Speed" with intention. It was designed and built to place more power, more speed at the service of the user and it delivers the goods!

Timken Roller Bearings, hardened broached gears, heat treated multiple splined shafts and spindle, multiple disc clutch and efficient positive lubrication are only a few of the features incorporated in this new machine. Twelve speed changes from 125 to 1600 R.P.M., six feeds from .004 to .025 per revolution, power to drive a 3/16" drill 80 feet per minute and sufficient power to drive a 1 1/2" drill without difficulty.

### THE MORRIS MACHINE TOOL CO.

CINCINNATI, OHIO, U. S. A.

## Precision, Wide Range Production Capacity

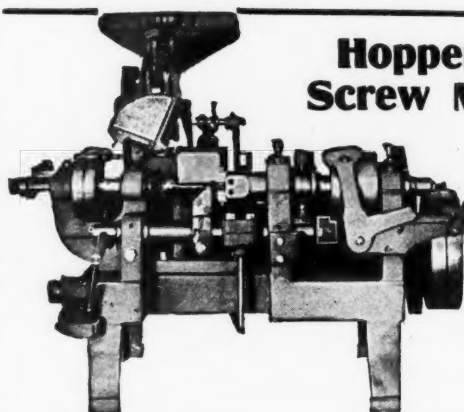
The Sigourney No. 0 Ball Bearing Sensitive Drill with speeds to 10,000 R.P.M., capacity to 3/16" and all ball bearing construction embodies the qualities to get most profitable results on the most used drilling range.



Simple design, correct balance, careful construction insure economical operation and efficient, durable service.

"Send for details of the Sigourney Line of Plain and Ball Bearing Drills."

The Sigourney Tool Company  
11 Sigourney Street, HARTFORD, CONN., U. S. A.



## Hopper Feed Screw Machines

for any Metal Cutting Operation or any Blanks fed from Hopper or Magazine

H. P. TOWNSEND MANUFACTURING COMPANY  
5 Chestnut Street HARTFORD, CONN.

**Tapping Machines which automatically reproduce the conditions of hand tapping with radically increased production.**

Write today for complete details

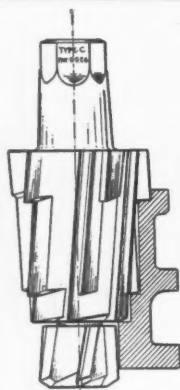
W. GATERMAN MFG. CO., MANITOWOC, WIS.



## Multiple Drill Head

Readily converts any single spindle type drill press into a multiple drill. Spur geared, ball bearing and fully adjustable. Increases production. Get facts and figures.

THE BUHR MACHINE TOOL CO.  
839 Greene St., Ann Arbor, Mich.



Factory and Office: Detroit, Michigan

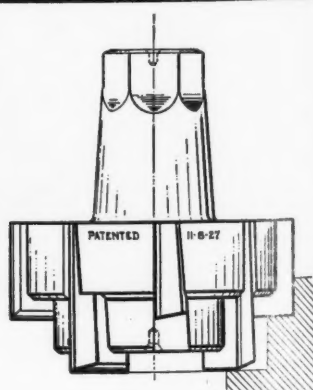
# GAIRING

MULTIPLE OPERATION TOOLS  
COUNTERBORES SPOTFACERS  
CORE DRILLS REAMERS

Gairing Tools are specially designed for end cutting and find wide adaption to general machine shop and production work.

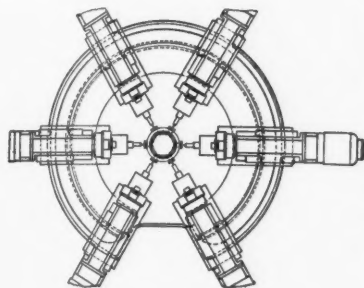
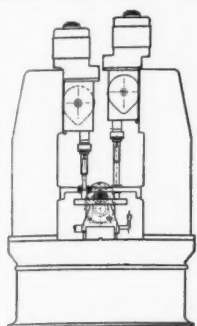
Send us your blue prints or samples of work and we will recommend tools designed to operate successfully at the lowest cost per hole. Catalog and engineering data mailed on request.

THE GAIRING TOOL COMPANY  
1635-37 W. LAFAYETTE BLVD. DETROIT, MICHIGAN



Representatives in Principal Cities





Other types of Millholland Drilling Machines. Send us prints of your jobs and we will submit interesting recommendations on the type of Millholland Automatic Drilling Machines adapted to the work.

## MILLHOLLAND Production Drilling

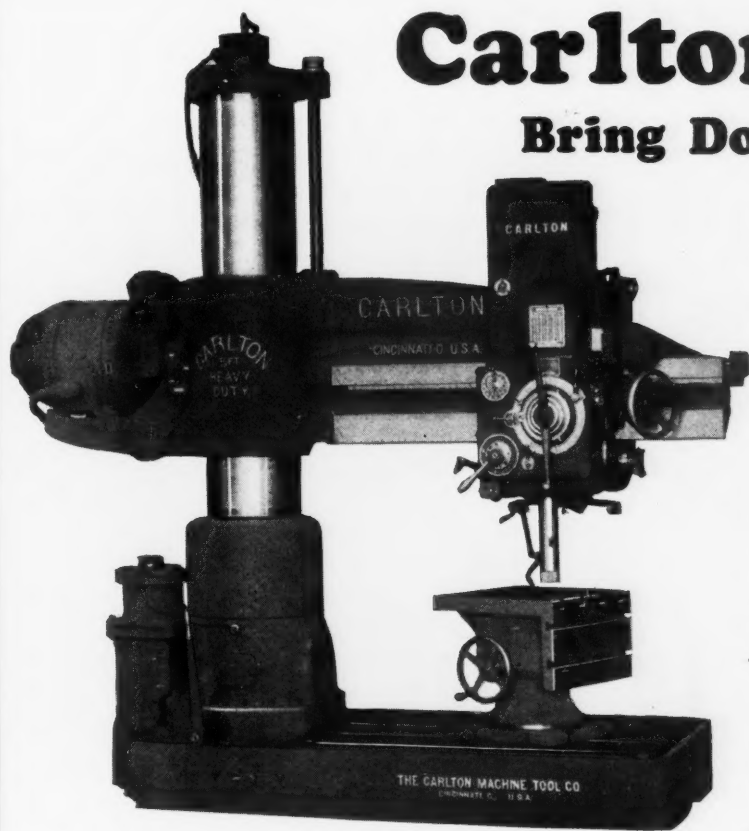
The Millholland Station Type Automatic Indexing Machine lowers production costs and raises operating standards on a wide range of drilling, reaming, counter-boring, spotfacing, etc.

Made in horizontal and vertical models—spindle can be equipped with multiple drill head for group operations performed simultaneously or in progression.

*Here are range, production, capacity and service standards—may we give you details?*



**MILLHOLLAND SALES & ENGINEERING CO.**  
1833 Ludlow Avenue, INDIANAPOLIS, IND.



Sizes 3, 4, 5, 6, 7 and 8 ft., any style table, electric or compressed air column binder, power traverse of head on arm, any style motor drive. Write for details.

## Carlton Radials Bring Down Drilling Costs

Carlton Radials have been on the market for more than seven years, and in that time have proved their ability to give satisfactory drilling service at a cost low enough to meet the most stringent demands. A few of their up-to-date features are ball bearings throughout, unit principle of construction, all steel gears running in oil, concentrated and convenient control, quiet operation at all speeds, low-hung drive to spindle.

**THE CARLTON  
MACHINE TOOL CO.**  
CINCINNATI, OHIO, U. S. A.



## No. 2 Heavy Duty Wall Radial Drill



By a number of new improvements in design, the Wickes No. 2 Wall Radial Drill reduces handling time losses and direct labor costs.

Machine can be arranged with power elevating device or for rigid attachment to wall; carriage can be arranged either for hand feed or power feed.

Drilling capacity up to 1½ in., reaming capacity up to 2 in. in diameter; arm lengths range from 10 to 18 feet.

*Write for Bulletin RD-1*

### Other Products

Plate Bending Rolls  
Angle Bending Rolls  
Plate Straightening  
Rolls  
Punching & Shearing  
Machinery  
Flanging Clamps  
Crankshaft Turning  
Equipment  
Heavy Duty Engine  
Lathes  
Blue Printing Machines

1856

**WICKES BROTHERS**

1928

Saginaw, Michigan, U. S. A.

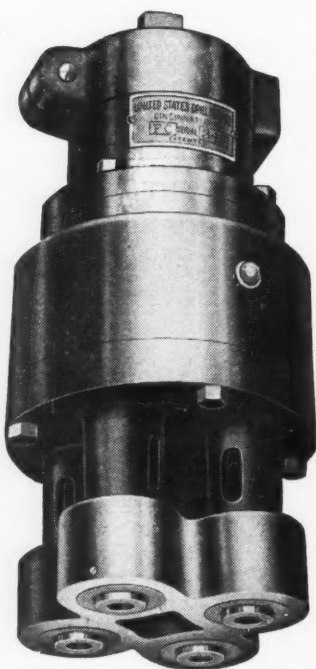
501 Fifth Ave., New York

736 White-Henry Bldg., Seattle

## U.S. Multiple Drill Head

With this simple attachment on your one-hole-at-a-time drilling machine you can drill two, six or a dozen holes in the time it takes to drill one, and at a fraction of the cost of a multiple spindle drill press.

Send blueprints or sketches for our estimate of the savings possible on your work.



### United States Drill Head Co.

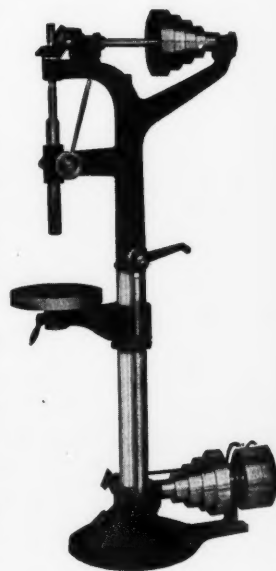
1948 W. Sixth Street, CINCINNATI, OHIO  
Michigan Agents—National Sales Engrg. Corp., Detroit

## Specialists Prescribe

That's what happens when our engineers recommend a Sibley model to handle your drilling work.

Sibley engineers are drill specialists—they know how to build drills and know too the machine that will give maximum satisfaction in your service.

The Sibley 16" Hi Speed Stationary Head Sensitive Drill has selective speeds ranging from 150 to 1700 R.P.M., construction is simple, lubrication positive, operation smooth and production profitable.



*Send for details of Sibley Drills—let specialists prescribe for your production problems.*

### SIBLEY MACHINE COMPANY

8 Tutt Street

South Bend, Ind., U. S. A.

# Make Sales Outspeed Shipments

**S**TRENGTHEN your sales program with a sound deferred payment plan and see the unfilled orders grow!

You will make more sales to more customers in less time.

Commercial Credit instalment merchandising plans—tried and found true during sixteen years of deferred financing experience—are now being applied profitably and with complete success by manufacturers of machinery and equipment throughout the United States.

Let us explain and show you how others have increased sales and profits.

## Commercial Credit Companies

COMMERCIAL BANKERS

Cash Capital and Surplus \$30,000,000

NATIONAL HEADQUARTERS - - BALTIMORE

*See Next  
Page*

Wherever you are—Whatever you make, sell, or buy—  
Investigate Commercial Credit Service



# Beat Competition

with a Sales Plan  
that makes Paying  
as Easy as Buying

**M**ANY of your prospects want your machine or product —want it badly. They need it to cut their manufacturing and operating costs. They know that your equipment will save its purchase price in six, twelve, eighteen, twenty-four months, but—

They have other and more important needs for their cash. They dare not risk cash stringency, even though they realize the advantages to be derived from the purchase of your product.

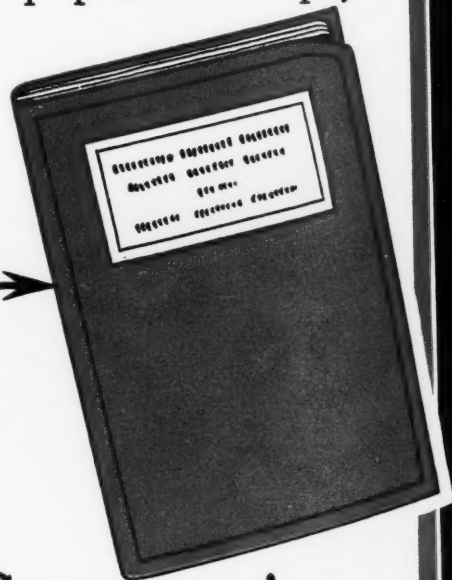
A Commercial Credit deferred payment plan, will make it possible for these prospects to buy your equipment and pay for it from its accrued savings.

Meet the buying needs of your prospects. Make more sales—at a profit to your customers and to yourself. They save, you serve and *sell*.

Back up your salesmen with Commercial Credit service. It pays.

Send for this Brief→

"BROADENING MACHINERY  
MARKETS — INCREASING  
SHOP EFFICIENCY THROUGH  
MODERN FINANCING  
METHODS"



## Commercial Credit Companies

COMMERCIAL BANKERS

Cash Capital and Surplus \$30,000,000

COMMERCIAL CREDIT COMPANY . . . BALTIMORE  
COMMERCIAL CREDIT CORPORATION . . . NEW YORK

COMMERCIAL CREDIT TRUST . . . CHICAGO  
COMMERCIAL CREDIT COMPANY, Inc. . . NEW ORLEANS

COMMERCIAL CREDIT COMPANY . . . SAN FRANCISCO

NATIONAL HEADQUARTERS . BALTIMORE

## DEFIANCE—A Valuable Production Trio

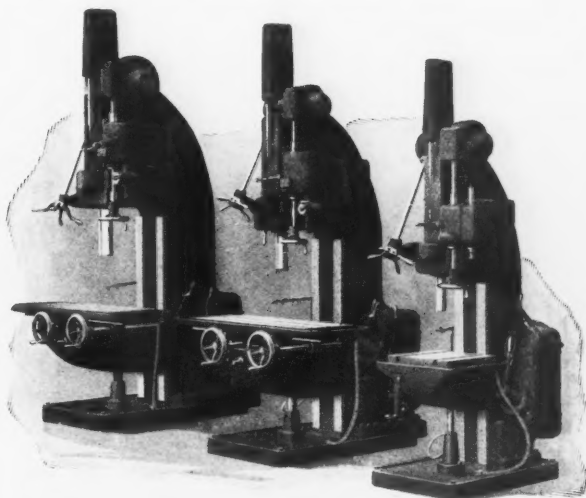
Defiance Heavy Duty Drills are made to drill holes to 2", 3", or 4" diameter in solid steel and built to get top-notch production, to operate with maximum efficiency in this exacting service.

Forged high carbon steel spindle equipped with S.K.F. thrust bearings, gravity oiling system, helical gear spindle nose drive, roll in gear—which greatly simplifies gear changes—and other features enable these Defiance Drills to meet production demands, set service standards in the modern plant.

Send for details of these machines and the remainder of the Defiance Line.

### THE DEFIANCE LINE

HORIZONTAL BORING MILLS  
CYLINDER BORING MACHINES  
HEAVY SERVICE DRILLING MACHINES  
RAIL DRILLS  
MULTIPLE DRILLING MACHINES  
MULTIPLE TAPPING MACHINES  
VALVE GRINDING MACHINES



### The Defiance Machine Works

Defiance, Ohio, U. S. A.

New York

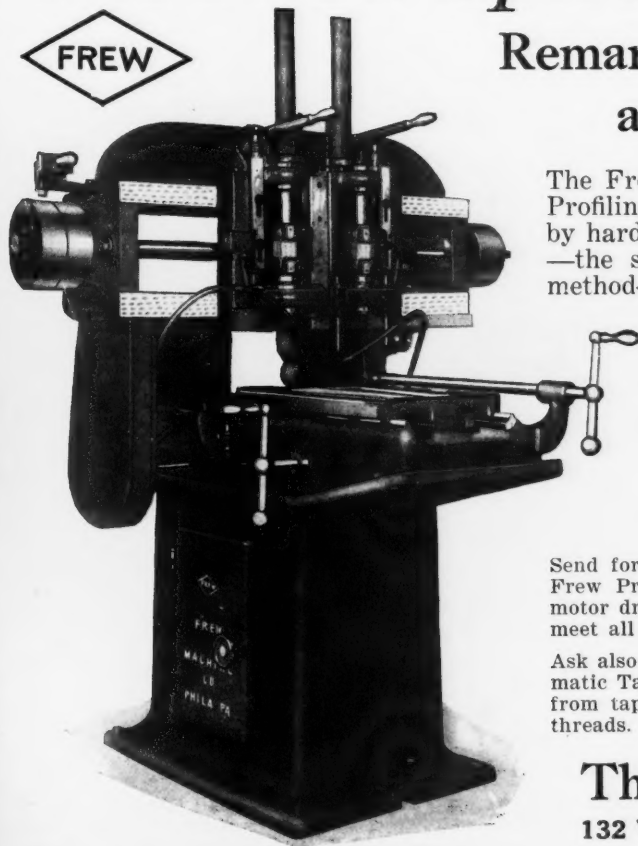
Since 1850

London

## The Frew *Spiral* Gear Profiler

FREW

### Remarkable Accuracy and Profitable Production

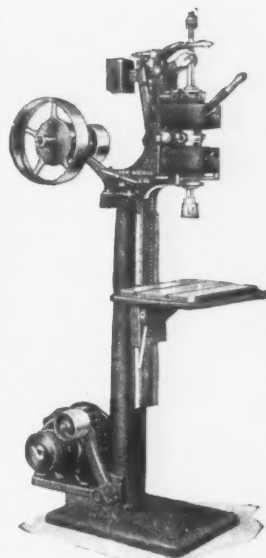


The Frew No. 5 Spiral Gear Driven Profiling Machine has spindles driven by hardened and ground spiral gears—the simplest, most direct driving method—and are double cut to prevent back lash.

Power applied without waste makes it available where it's needed—at the cutting tool—and by reducing vibration to the minimum gives the greater cutting accuracy so important in a machine of this type.

Send for details of this machine and other Frew Profilers—the line includes belt and motor driven machines in sizes and types to meet all needs in this class of work.

Ask also for details of the Frew No. 1 Automatic Tapper for fast, accurate tapping free from tap breakage, stripped and inaccurate threads.



### The Frew Machine Company

132 W. Venango Street

PHILADELPHIA, PA.

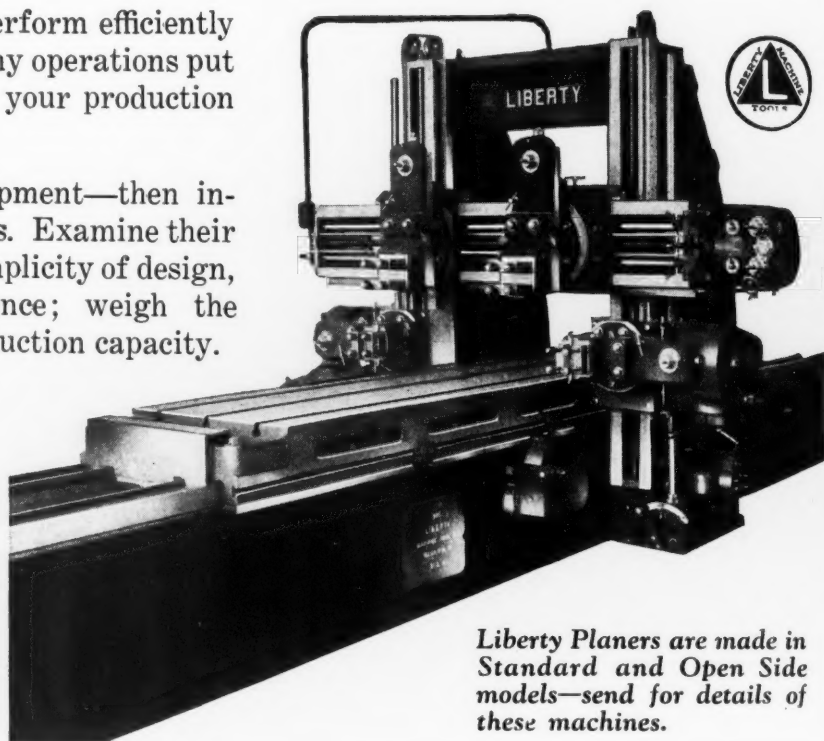
# Your Planer Equipment

Is it modern? Will it perform efficiently *and economically* the many operations put up to it in the course of your production program?

Study your planer equipment—then investigate Liberty Planers. Examine their construction, note the simplicity of design, the operating convenience; weigh the *profit value* of their production capacity.

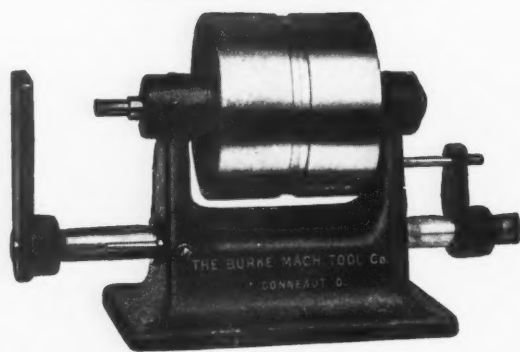
**The Liberty  
Machine Tool  
Company**

HAMILTON, OHIO



*Liberty Planers are made in Standard and Open Side models—send for details of these machines.*

## BURKE



### Efficient Light Tapping

Burke Tapping Machines are capable of handling a wide range of reaming, tapping, burring, countersinking, etc., on unusually high production schedules. They are practically automatic; the operator has only to feed and remove the work, and it is kept to the highest standards of accuracy regardless of speed.

Burke Tapping Machines are extremely economical to run, consuming little power and seldom breaking a tap. Thread stripage is unknown. For full particulars write.

**The Burke Machine Tool Company**  
516 Sandusky Street, CONNEAUT, OHIO, U. S. A.

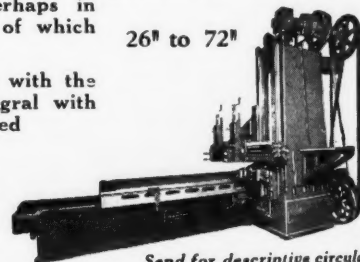
### Cleveland Open Side Planers

THE PROOF IS PERFORMANCE—To tell you of the superior merits of Cleveland Open Side Planers with the customary elaboration means so little when compared with an actual running demonstration perhaps in your vicinity, location of which will be sent on request.

26" to 72"

The Open Side Planer with the Column Base cast integral with its closed top Bed

Dial Feed; Power Rapid Traverse; Single Turn Rail Clamp; Improved Head Clamp; Box Table; Automatic Trip to Rail Raising Mechanism; Forced Feed Lubrication to Vees.



Send for descriptive circular

**THE CLEVELAND PLANER COMPANY**  
3148 Superior Ave. Established 1900 CLEVELAND, OHIO

### U. S. HAND MILLERS

For all classes of light milling

### U. S. SENSITIVE DRILLERS

For all classes of light drilling

SEND FOR CIRCULARS AND PRICES

**United States Machine Tool Co.** CINCINNATI, OHIO

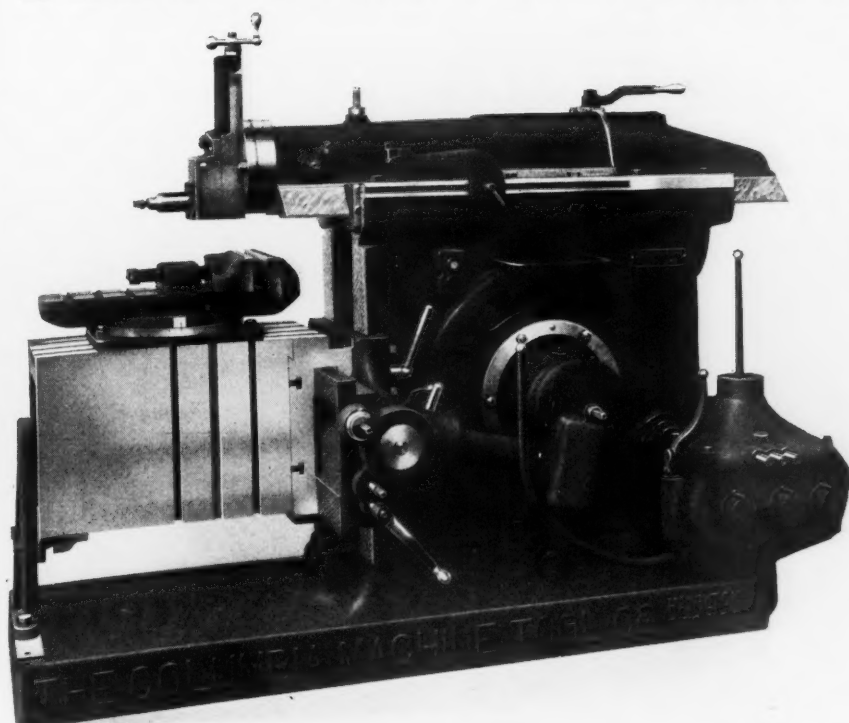
### Cone 4-Spindle Automatics

**CONE AUTOMATIC MACHINE CO., Inc., Windsor, Vermont**  
Agent for Michigan Territory: J. C. Austerberry, 684-690 E. Congress St., Detroit, Mich.  
Chicago Representative: John H. Glover, 2127 North Sayre Ave.  
Ohio Representative: S. B. Martin, 1077 Erie Cliff Drive, Lakewood, Ohio

Economical, accurate producers of screw machine parts up to 4 3/8" by 7". They cut costs, increase production. Ask us to prove it. Write for particulars.



# COLUMBIA SUPERIOR SHAPERS



## COLUMN

Is flush in front, affording longer travel with tool head set for angular work.

Extends at rear to provide long bearing for ram.

Massive design prevents vibration under heavy cuts.

Another

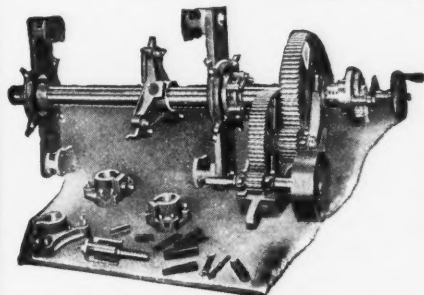
## COLUMBIA SUPERIOR FEATURE

Full Details on Request

Sizes 16", 20", 24", 28", 32", 36". Single Pulley or Motor Drive.

**THE COLUMBIA MACHINE TOOL CO., Hamilton, Ohio, U.S.A.**

## Underwood Portable Tools A Tool for Every Purpose



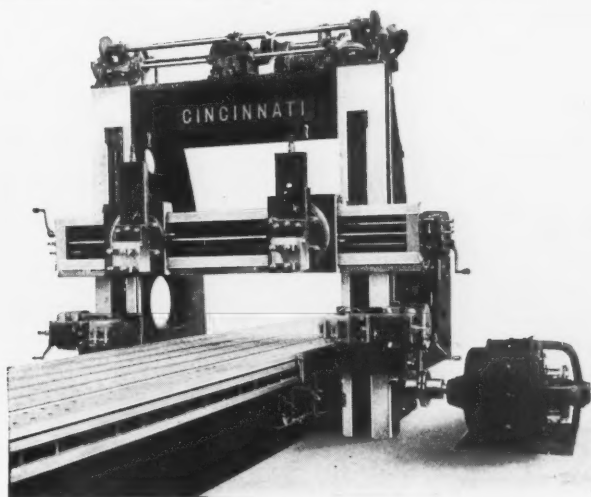
Portable  
Boring Bars  
Crank Pin Turn-  
ing Machines  
Pipe Benders  
Rotary Planers  
Milling Machines  
Flue Cleaners  
Special Machines

**H. B. UNDERWOOD CORP., Philadelphia, Pa.**  
Established 1870

**HOEFER** Auxiliary Head  
Makes your single spindle drilling machine yield multi-spindle profits.  
Branches in Principal Cities  
**HOEFER MFG. CO.**  
FREEPORT, ILL.

## RADIAL DRILLS

**The Dreses Machine Tool Co.**  
Cincinnati, Ohio



## Planing That Pays

Planing that pays must be at all times equal to the highest production demands, and at all times equal to the closest limits of tool room accuracy.

Such planing is being performed in shops of all kinds, everywhere, with Cincinnati Planers. Look into these tools, regardless of your present equipment. Booklets on request.

**The Cincinnati Planer Co.**  
CINCINNATI, OHIO

# One Installation—Double Service

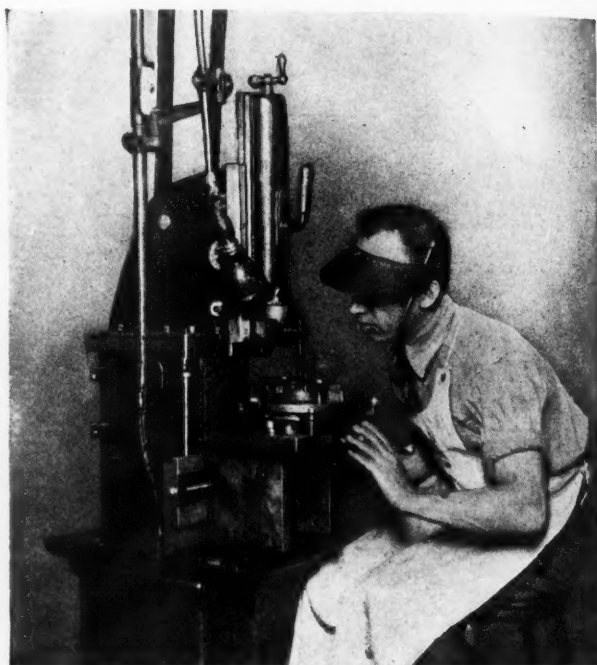
## THE RHODES SHAPER AND SLOTTER

Here—in one installation—you have a 7" Horizontal Shaper and a 3½" Vertical Slotter with a change over so easily and quickly made that the set up of the work is usually not disturbed and keyseating, slotting, shaping and many other operations may be performed without change of setting.

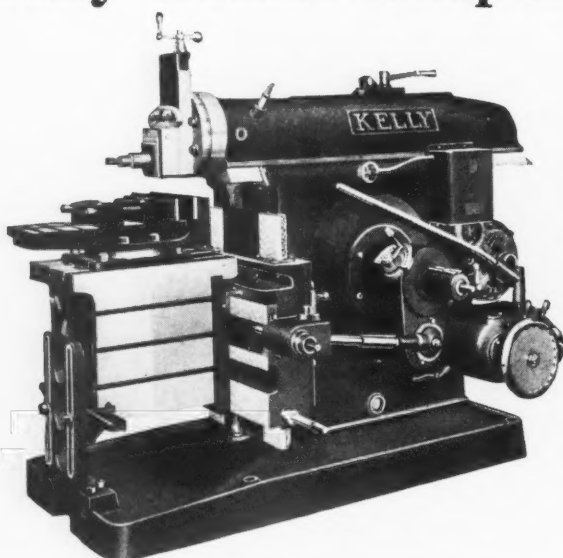
Dial adjustments graduated in thousandths insure accuracy; operating conveniences and ample power guarantee profitable production on all classes of work.

*Send for details of the Rhodes Shaper and Slotter*

**THE RHODES MANUFACTURING CO.**  
HARTFORD, CONN.



## Kelly Crank Shapers



### *A Product of Specialization*

For more than three decades fine shapers have been the exclusive product of the R. A. Kelly Company. And concentration on one product, bending every effort toward improvement, has made of the Kelly Shaper a machine of outstanding excellence.

14" Single Geared models, 16", 20", 24-26" and 30" Back Geared models. The Kelly Crank Shaper Book describes them. Copy on request.

**The R. A. Kelly Company**  
XENIA      Makers of Crank Shapers only.      OHIO, U. S. A.

### OLIVER OF ADRIAN

#### Die Making Machines and Drillpointers

will enable you to increase production for 1928

Die Making Machine

Automatic Drillpointer



Saves from 30% to 60%  
of Die Making Costs



Increases drilling efficiency  
from 30% to 50%

*Send for  
Bulletins*

**OLIVER INSTRUMENT COMPANY**  
1410 E. Maumee Street      ADRIAN, MICHIGAN

### Universal (Horizontal) Boring Machines Tri-Way Type

"Where Accuracy Counts, We Win"

**UNIVERSAL BORING MACHINE COMPANY**  
HUDSON, MASSACHUSETTS, U. S. A.

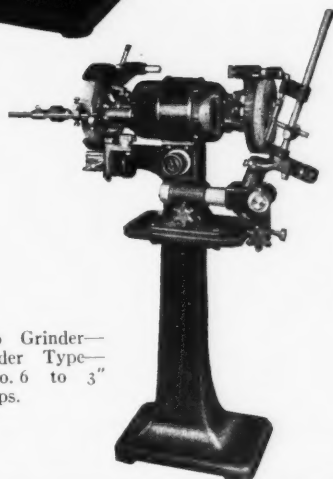
## Shapers Exclusively

Crank Sizes: 12", 14", 16", 20", and 25"—Either Cone  
Driven or through Speed Box, 32" B.G.  
All Geared Single Pulley Drive

**THE SMITH & MILLS COMPANY**  
CINCINNATI      OHIO, U. S. A.



Style C-6-A Drill Grinder.  
Direct Motor Driven.  
Takes No. 52 to 2½"  
Drills.



No. 12 Tap Grinder—  
Double Holder Type—  
Capacity No. 6 to 3"  
Taps.

## Efficient Drill and Tap Grinding for Every Shop

Important increases in drilling and tapping production rarely fail to make their appearance following the installation of Grand Rapids Drill and Tap Grinders—while breakage decreases amazingly.

Grand Rapids Grinders put taps and drills in the best possible condition for rapid, accurate work—they grind cutting edges and flutes with a uniformity and correctness impossible by hand methods. The machines are rugged, fool-proof—economical.

*Sizes and styles for every shop  
Let us supply details*

**Gallmeyer & Livingston Co.**

344 Straight Avenue, S. W.,  
Grand Rapids, Mich.

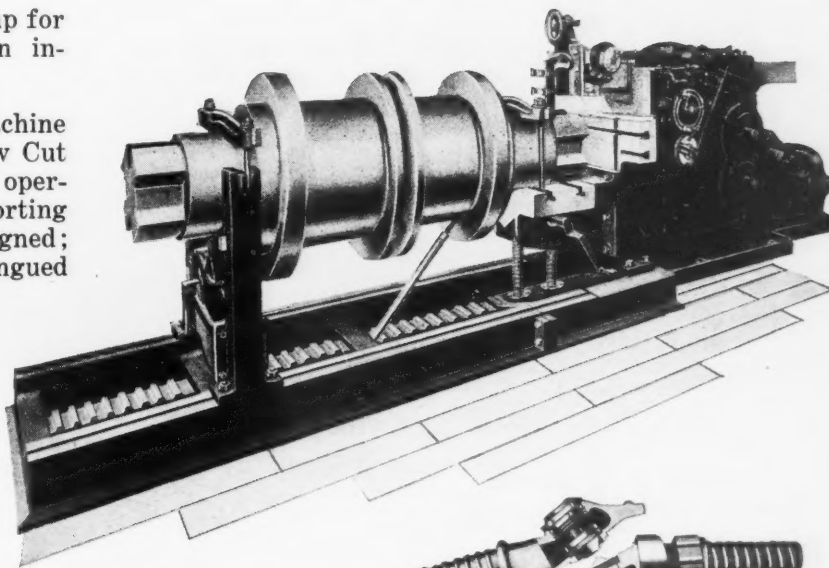
Export Dept.—233 Broadway, New York City.

## The Morton Roll Wabble Shaper

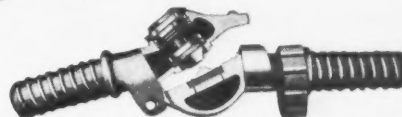
Design provides a convenient set-up for hard-to-handle work, construction insures accuracy on a difficult job.

The shaper construction of this machine is adapted from the Morton Draw Cut Shaper—a sufficient guarantee of operating efficiency. The work supporting frame is rigid and carefully aligned; the cast steel outer V-Block is tongued and fitted into the T-Slot.

Square slots are provided on each side of the supporting frame for V-Block adjustments, center rib with rack teeth for bracing against end thrust and ample clamping facilities insure accuracy in setting up heavy, bulky roll wabbles.



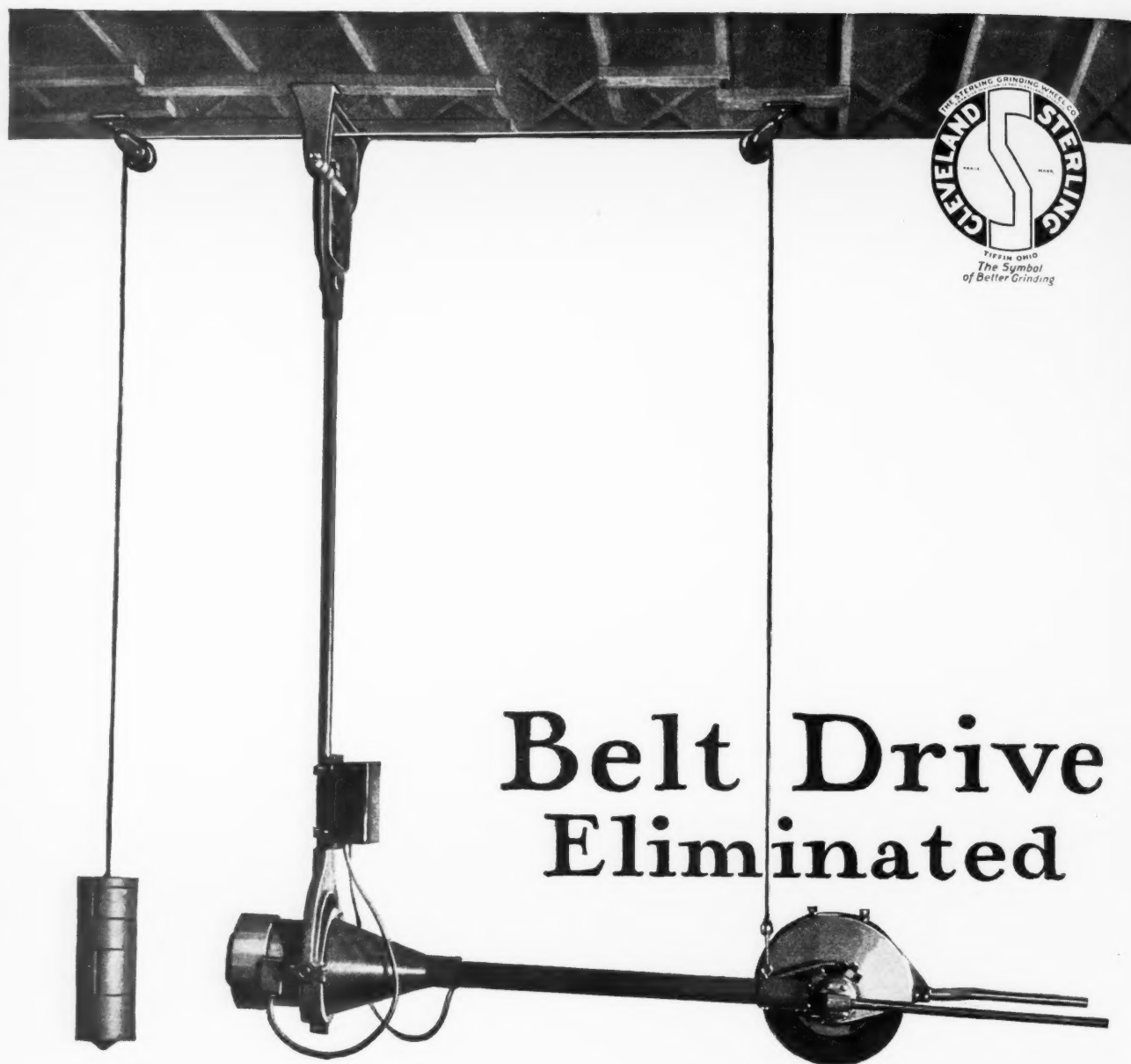
Bulletin 9-D gives details of Morton Draw Cut Roll Wabble Shapers and Planers; ask also about Morton Stationary and Portable Keyway Cutters, Heavy Duty Draw-Cut Shapers and Planers up to 60" of cutting stroke, Traveling Head Planers with 60", 72", and 84" of cutting stroke with any length of bed or height of column, Finished Machine Keys and Special Shapes as shown in our new Key Bulletin 15-D.



Robinson Automatic Air Hose Couplings for pipe and hose lines will eliminate your air losses. Use them without Globe valves and save this expense.

**Morton Manufacturing Co., Muskegon Heights, Michigan, U.S.A.**





## Belt Drive Eliminated

One of Sterling's contributions to more and better grinding is the Sterling Swing Frame Grinder. Electrically driven. Eliminates belt drive.

Equipped with ball bearing motor and push button starter. Can be started and stopped instantly. Motor is connected to drive shaft by thermoid coupling and at wheel head are case hardened spiral motor gears, same principle as regular automobile differential.

This new Sterling Swing Frame

Grinder can be handled in less space and with less effort. Can be swung on an angle of 45 degrees without extra effort or adjustment of any kind. Absolutely in balance and is adjustable to accommodate operator. Can be furnished to swing 18- and 20-inch wheels, and either center or rear suspension.

Placed on the market last year, the Sterling Swing Frame Grinder has quickly

been adopted by many plants and is helping to realize the Sterling goal of more and better grinding.

**THE STERLING GRINDING WHEEL COMPANY**

Abrasive Division of The Cleveland Stone Co.

Factory and Office, Tiffin, Ohio. Branch at 23 S. Jefferson St., Chicago.

**STERLING ABRASIVES**  
**AND STERLING GRINDING MACHINES**

# INCREASED SALES!

JUNE

MAY

APRIL

MARCH

FEBRUARY

JANUARY

DECEMBER

NOVEMBER

OCTOBER

SEPTEMBER

AUGUST

JULY

The Tremendous  
Response to  
Improved Quality



Give this New  
ABRASIVE  
WHEEL  
a Test

Attributed to  
Ceramic, Chemical  
and  
Mechanical Research

Experienced Field  
Engineers

Higher Standards of  
Quality and Service



GRINDING WHEELS

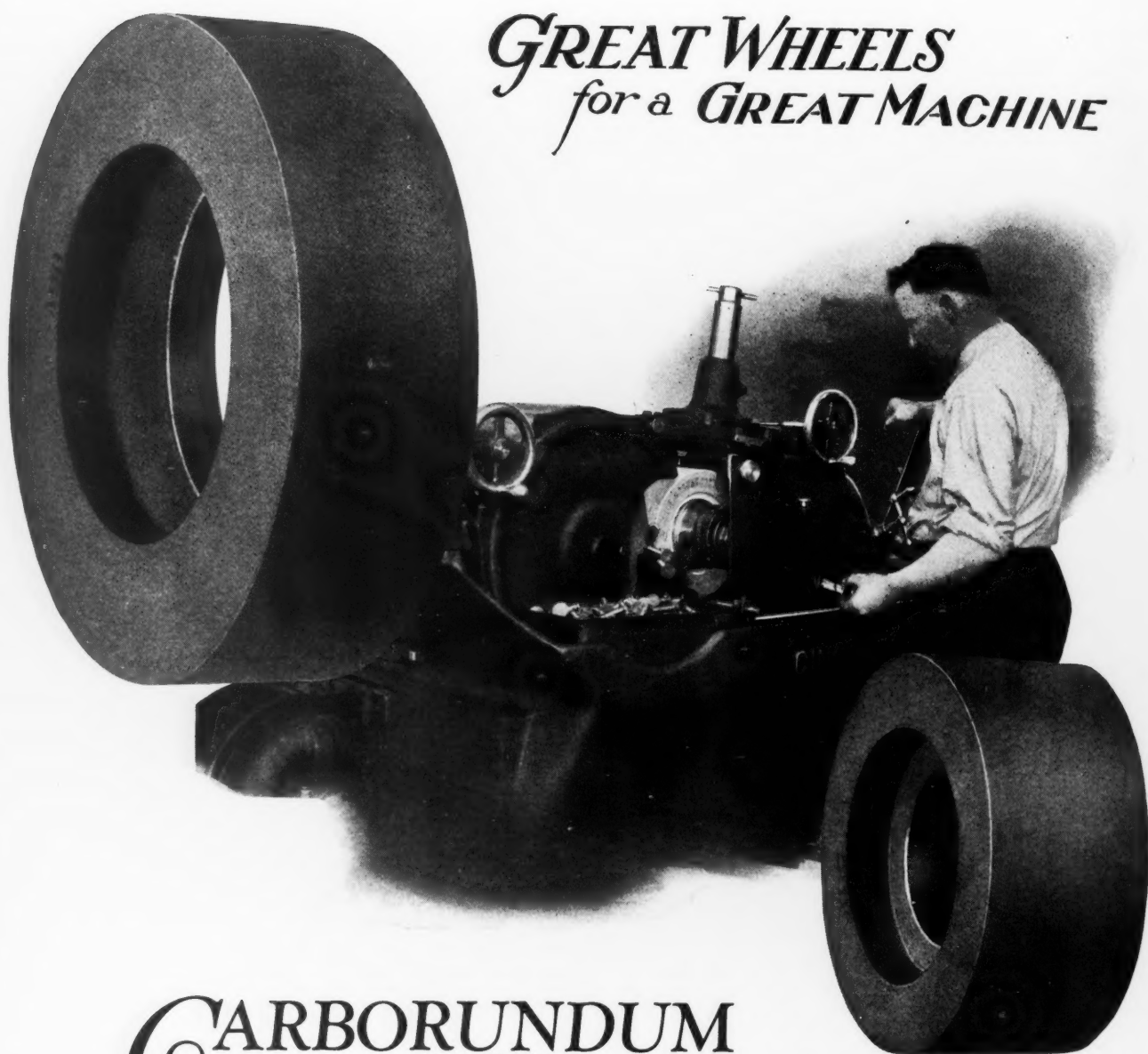
POLISHING GRAIN

## ABRASIVE COMPANY

127 S. Green St., Chicago, Ill.

Tacony and Fraley Sts., Phila., Pa.

149 Larned St., E., Detroit, Mich.



*GREAT WHEELS*  
for a *GREAT MACHINE*

**CARBORUNDUM**  
REG. U.S. PAT. OFF.  
and **ALOXITE WHEELS**  
*for the Cincinnati Centerless*

**P**RODUCTION—speed—finish—accuracy from these wheels that are accurately graded, specially built for Centerless work.

Carborundum for cast iron, brass, bronze, etc. Aloxite for steel—in both the grinding and the regulating wheel.

Carborundum is the Registered Trade Name used by The Carborundum Company for Silicon Carbide. This Trade Mark is the exclusive property of The Carborundum Company.

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

CANADIAN CARBORUNDUM CO., LTD., NIAGARA FALLS, ONT.

SALES OFFICES AND WAREHOUSES IN New York, Chicago, Boston, Philadelphia, Cleveland, Detroit, Cincinnati, Pittsburgh, Milwaukee, Grand Rapids  
The Carborundum Co., Ltd., Manchester, England Deutsche Carborundum Werke, Dusseldorf, Germany



# GARDNER SINGLE-PURPOSE GRINDERS

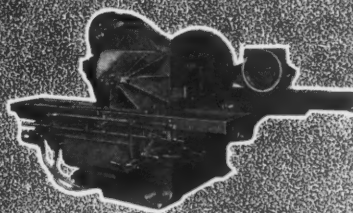
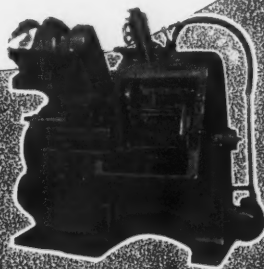
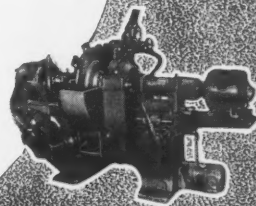
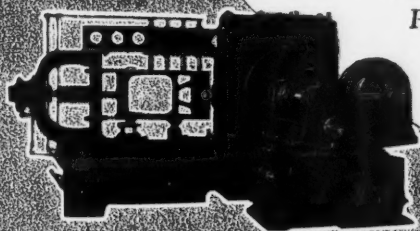
THE production officials of a nationally known boiler factory were faced with the problem of speeding up production on some of their large boiler sections. They installed a Special-Purpose Gardner Grinder, and cut their grinding time in half.

In a large automobile shop, it became necessary to cut the finishing time on connecting rods, and to secure greater accuracy. Three Special-Purpose Gardner Grinders are getting the desired results today.

Wherever flat surface operations must be performed under *greater-than-ordinary production requirements*, production executives are turning to Gardner Single-Purpose Grinders.

And the excellent record made by many of these tools is the best assurance that they will not fail in the work which they are intended to do.

Ask for our BOOKLET—"ACTUAL APPLICATIONS of SPECIAL-PURPOSE GARDNER GRINDERS"

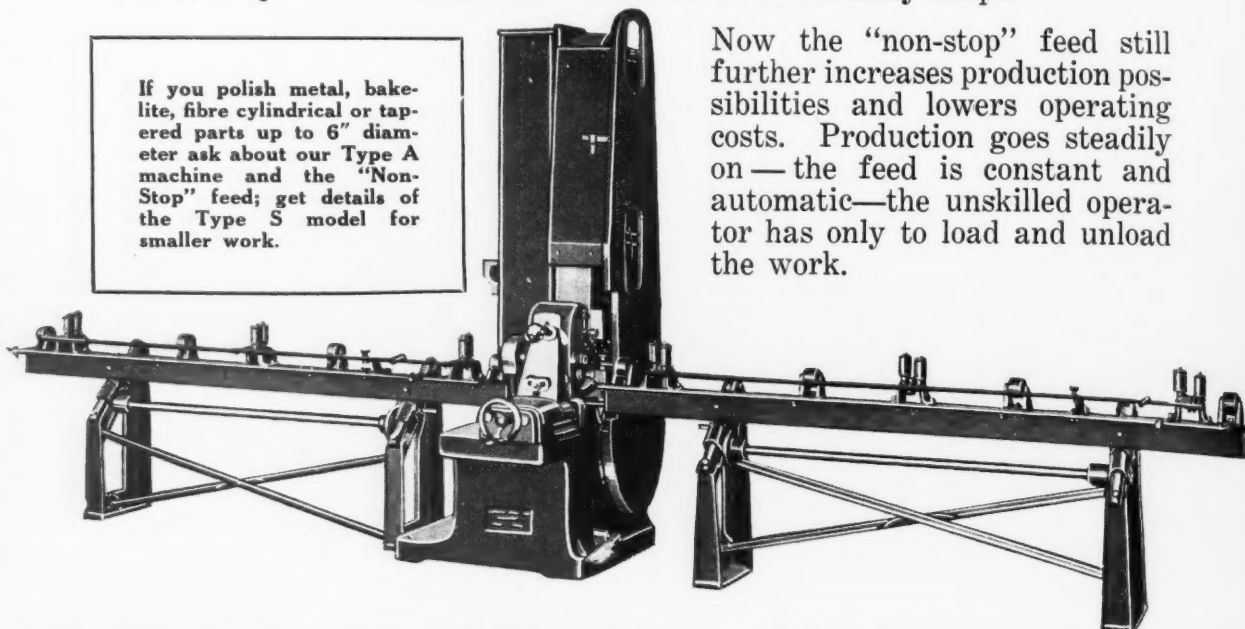


Specialists in Grinding Equipment

## Speed the Feed to PRODUCTION POLISHING AND FINISHING MACHINES

Finishing from 3 to 5 times the work possible by hand polishing, with capacity for cylindrical and tapered work to 6" diameter and a wide range of flat work, Production Polishing and Finishing Machines have revolutionized these operations on certain classes of work in many shops.

If you polish metal, bakelite, fibre cylindrical or tapered parts up to 6" diameter ask about our Type A machine and the "Non-Stop" feed; get details of the Type S model for smaller work.



Now the "non-stop" feed still further increases production possibilities and lowers operating costs. Production goes steadily on—the feed is constant and automatic—the unskilled operator has only to load and unload the work.

**PRODUCTION MACHINE CO., Greenfield, Massachusetts, U. S. A.**

Hotch & Merryweather Machinery Co., Cleveland, Detroit, Pittsburgh, Cincinnati. Production Machine Co., 4856 S. Halsted St., Chicago, Ill.

THE average machine shop's entire range of grinding work can be handled by the Thompson Universal Grinder—speedily and economically. It requires but little floor space, little power and little attention. The first cost is usually the only cost—but profits never cease. An important feature is the worktable which is presented to the stationary wheel-head at any angle, permitting grinding between centers, edge, surface and cutter and die grinding.

**The Thompson Grinder Co.**  
1534 W. Main Street  
Springfield, Ohio, U. S. A.

**Thompson  
Grinding  
Costs Less  
and  
Produces  
More**

*Bulletin 18  
has the  
full story.  
Write for it.*

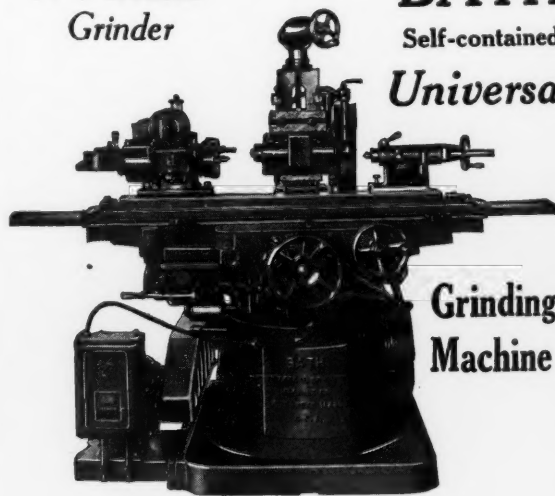


*A Versatile  
Grinder*

**BATH**

Self-contained

**Universal**



**Grinding  
Machine**

THE Bath Grinder embodies many distinctive and desirable features essential for rapid and accurate production of commercial and tool room grinding.

This machine is adapted for the grinding of cylindrical, internal, surface, disc, cutter and reamer work of all kinds. Made in 2 sizes—12 x 36; 10 x 25. Drop a post card for catalog.

**Fitchburg Grinding Machine Corp.**  
Fitchburg, Mass.



# VITRIFIED

## "Borite" For Grinding Steel

The Vitrified Wheel Company's "Borite" wheels are especially prepared for the speedy rough grinding of malleable iron and steel castings and forgings. Used on stand, swing frame or portable grinders they make short work of cleaning up the heaviest jobs. High cutting speed sets a fast production pace—and keeps the cost at a very low level.

A representative demonstrating "Borite" savings at your service—any time you say.

**VITRIFIED WHEEL CO.**  
WESTFIELD, MASS.



**VITRIFIED**

### **Borite**

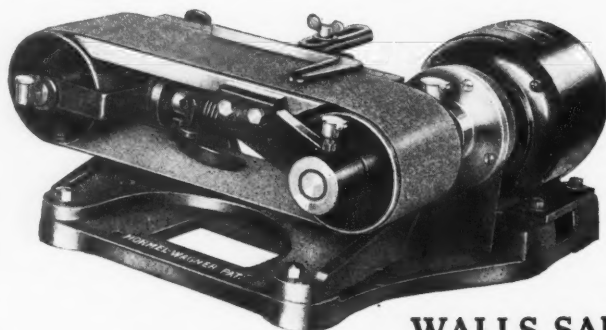
For all kinds and classes of steel grinding.

### **Carborite**

For all classes of cast iron, brass, bronze and aluminum grinding.



## Simplex-M Abrasive Band Grinder or Bench Sander



**For ROUGHING  
SMOOTHING or  
FINE FINISHING**

PRODUCING STRAIGHT GRAIN FINISH  
AND SHARP EDGES

They are in use in shops the country over,  
accelerating production and shaving finishing  
costs of Metal, Bakelite, Fibre, Celluloid and  
Wood parts.

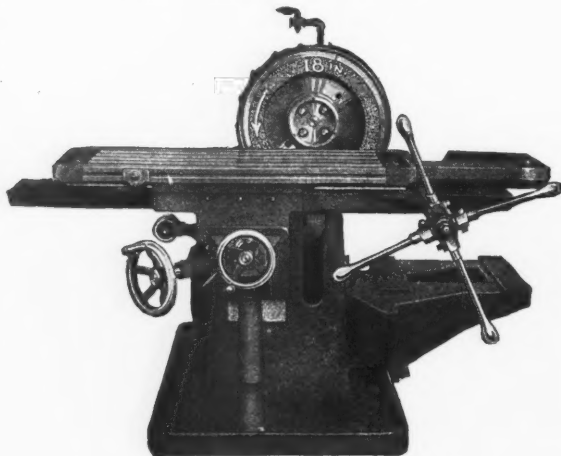
*The Simplex-M is one of our many styles and sizes*

**WALLS SALES CORP., 96 Warren St., New York**

## FLAT WORK GRINDERS

TWO SIZES 12"-18" HIGH GRADE

*For rapid production of flat surfaces that  
will be straight from end to end*



**18-inch Grinder**

Showing Motor Bracket. Water Guard Omitted.

*You can readily fasten stationary, rotary or Magnetic  
Holders on the table to suit your particular case*

**ADAPT AND USE AS A BASE**

A good example is our **PULLEY GRINDER** on which  
we have special circulars.

**THE GRAHAM MFG. CO.**  
71 Willard Avenue Providence, R. I.

Great Britain—Richard Lloyd & Co., Ltd., Birmingham  
France, Italy, Switzerland, Spain and Holland—Fenwick Freres & Co.

## Can You Broach It?

Broaching—with Lapointe Broaching Equipment—is saving  
time and labor on operations formerly done by more expensive  
means. Our Engineers are ready to tell you how. Write.

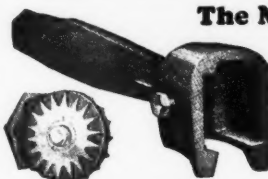
**THE LAPOINTE MACHINE TOOL COMPANY, Hudson, Mass., U. S. A.**

## BADGER TOOL COMPANY Grinding Machinery Supplies and Accessories

E. B. GARDNER, President R. D. GARDNER, Treasurer  
BELOIT, WISCONSIN, U. S. A.

## DESMOND-HEX DRESSER

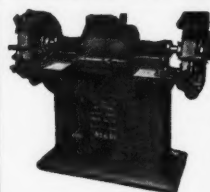
**The Most Durable Type of  
Mechanical Dresser  
Made**



In the Desmond-Hex (Huntington-type) Dresser the hexagonal, hardened-steel nuts inserted in the jaws of the Dresser have six holes, each of which, in turn, becomes the bearing for the spindle carrying the cutters. Will outwear a dozen ordinary Dressers. Made in three sizes.

**The Desmond-Stephan Mfg. Company**  
URBANA, OHIO

The Canadian Desmond-Stephan Mfg. Co., Ltd., Hamilton, Ont. Alfred Herbert, Ltd., Coventry, England, Agent for Great Britain.



## Modern Grinding Equipment

Bridgeport Grinders are finely made machines—well balanced, true running, dependable. They will give you low costs on any grinding job. Ask about the new 32" and 42" Hydraulic Face Grinders.

**The Bridgeport Safety Emery Wheel Co., Inc.**  
1283 West Broad St. Bridgeport, Conn.

## Emery Wheel Dressers

Two Sizes

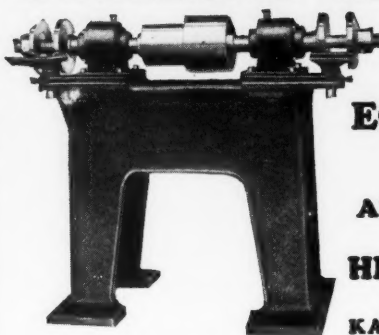
**CUTTERS**

Nos. 1-2

We make the regular Huntington (Pattern) for all sizes.  
Roughing for Nos. 1 and 2. Paragon for No. 1 only.

**GEO. H. CALDER CO., Lancaster, Pa., U.S.A.**

## HILL-CURTIS BALL BEARING GRINDING MACHINES



**GIVE  
ECONOMICAL  
SERVICE**

**All Types and Sizes**

**HILL-CURTIS CO.**

1604 Douglas Ave.  
KALAMAZOO, MICHIGAN

# WRIGHT AERO

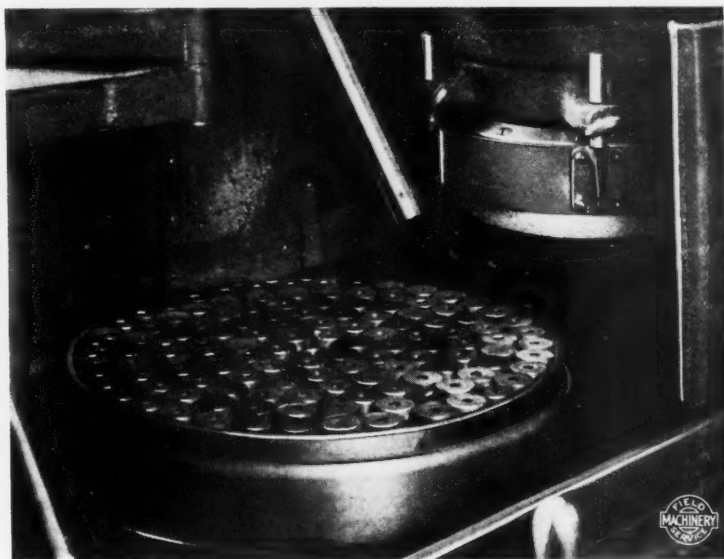
*Saves Time with a*

## BLANCHARD GRINDER

The Wright Aeronautical Corporation of Paterson, New Jersey—makers of the now internationally famous aeroplane engines—perform many important operations on a Blanchard No. 10 Grinder. Some of these jobs must be held to close limits, and of course rapid and steady production is an important consideration. Master rods, ratchet rollers, washers, spacers and valve tappet rollers are some of the parts machined.

The parts on the machine when the photograph was made were valve tappet rollers of hardened steel. These are ground in one operation, per side, taking 0.010" to 0.015" off each side, and are held to limits of  $\pm 0.001$ ". The hourly output of these parts is 200.

The Blanchard saves time and money because its speed is coupled with quick adaptability to a variety of work.

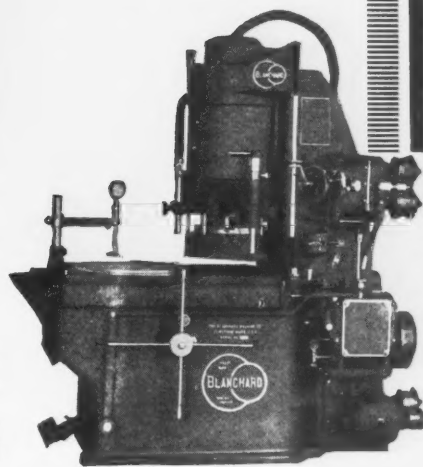


On all kinds of flat grinding work Blanchard Grinders save time, labor, material, fixtures and metal—they assure parallelism and work to close limits. Let us tell you about them.

**The Blanchard Machine Company**  
64 STATE ST., CAMBRIDGE, MASS., U. S. A.

#### DEALERS

UNITED STATES—Henry Prentiss & Co., Inc.; Mote & Merryweather Machinery Co.; Marshall & Huschart Machinery Co.; W. E. Shipley Machinery Co.; Kemp Machinery Co.; Marshall & Huschart Machinery Co. of Indiana; Elliott & Stephens Machinery Co.; Robinson, Cary & Sands Co.; Harron, Rickard & McCone Co.; The Hendrie & Bolthoff Mfg. & Supply Co.; Huey & Philp Hardware Co.; Woodward, Wight & Co., Ltd.  
CANADA—Williams & Wilson, Ltd.; F. F. Barber Machinery Co.  
GREAT BRITAIN—Burton, Griffiths & Co. FRANCE—Aux Forges de Vulcain. SWEDEN—Maskinaktiebolaget, Karlebo. JAPAN—Andrews & George Co. CZECHOSLOVAKIA—Ing. M. Kocian & G. Nedela. GERMANY—Schuchardt & Schutte A. G. SOUTH AFRICA—D. Drury & Co., Ltd. HOLLAND, BELGIUM & COLONIES—R. S. Stokvis & Zonen. SWITZERLAND—C. Schinz & Co.

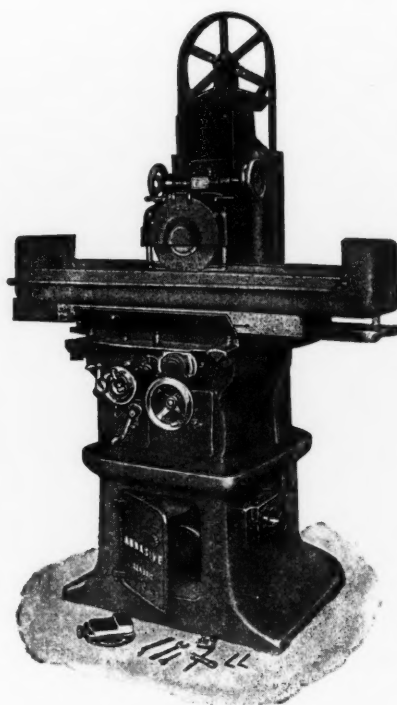


# No. 3 ABRASIVE

A Surface Grinder worthy of consideration for any type of Flat Grinding.

Because of its rugged construction and variety of equipments, it has made high production jobs out of tool-room work.

Capacity 22' x 8' x 12'



Abrasive Machine Tool Co., East Providence, R. I.

*And Here Is Why—*



THE  
**Blount**  
J. G. BLOUNT CO. EST. 1888

5 H. P.

Heavy Duty

**GRINDERS**

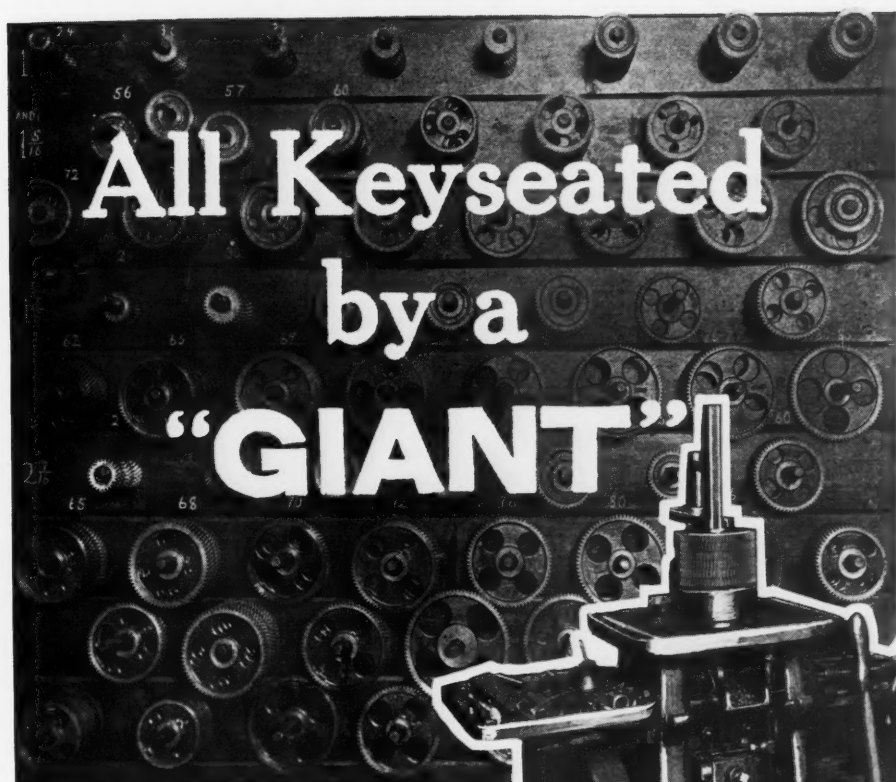
**STAND THE GAFF**

1. Exceptionally heavy rigid construction.
  2. Fully Enclosed Continuous Rated Motor.
  3. Automatic Starters, Overload and Low Voltage Protection, Push Button Control.
  4. Heavy Duty Double Row Deep Groove Ball Bearings.
  5. Extra Heavy Carbon Steel Spindle.
  6. Positive Double Seal for Bearings against Dust and Dirt.
  7. Fully enclosing Safety-Code Wheel Guards with exhaust outlets and adjustable for wear.
- Designed for severe continuous service they perform year in, year out with marked economy.

Write for complete information Now

**J. G. BLOUNT CO.**  
EVERETT MASS., U. S. A.



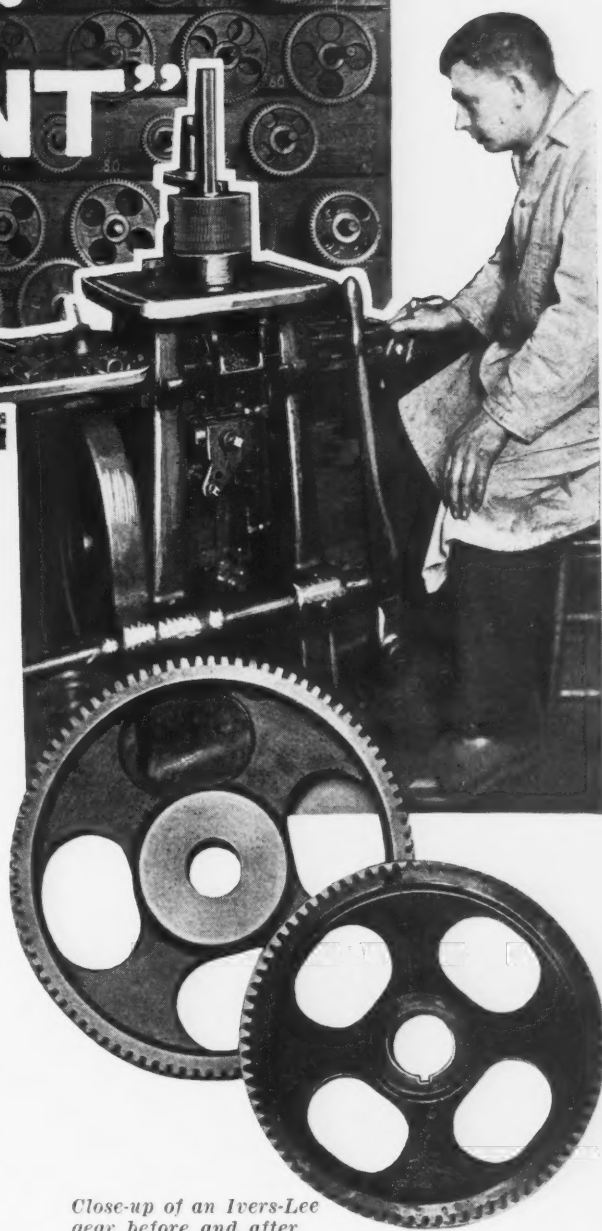


## Gears for Automatic Pill Wrapping Machines

This **"GIANT"** Keyseater No. 2 not only cuts accurate keyseats in these important parts but also does this work on lever forgings, cams, bushings, collars and other parts for the wrapping machines manufactured by the Ivers-Lee Co., Newark, N. J.

**"GIANT"** convenience enables them to handle a wide range of work with complete efficiency; **"GIANT"** power enables them to put much of it through on a production basis by proceeding as in this operation where six gears are keyseated in one set-up and the machine completes the lot (cutting keyseats  $3/16''$  by  $3/32''$  by  $5/8''$  face) in 12 minutes, floor to floor.


**"GIANT"** Keyseaters are made in 8 sizes, all equally profitable on a wide range of standard and special keyseating operations. Let us send you details.



*Close-up of an Ivers-Lee gear before and after Keyseating on the "GIANT." Note the clean, accurate keyway.*

**MITTS & MERRILL**  
843 Water Street, SAGINAW, MICH.

FOREIGN AGENTS: Burton Griffiths & Co., London, England. Aux Forges de Vulcain, Lyons and Paris, France. V. Lowener, Oslo, Norway and Stockholm, Sweden.



## Air and Industries

Compressed air has assumed an important place in modern industrial operations because it is a satisfactory medium of transmitting and utilizing energy. It is safe, easy to handle, and flexible.

Then, too, it is reliable. With compressors such as Ingersoll-Rand offers, failures in the air supply are exceedingly rare.

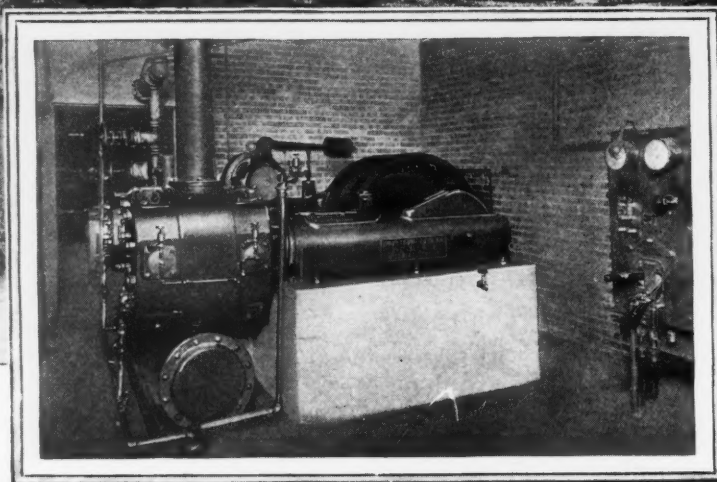
There is an I-R Compressor to fit every air requirement.

### INGERSOLL-RAND COMPANY

11 Broadway :: New York City

*Offices in Principal cities the world over*

For Canada refer—Canadian Ingersoll-Rand Co., Limited  
10 Phillips Square, Montreal, Quebec

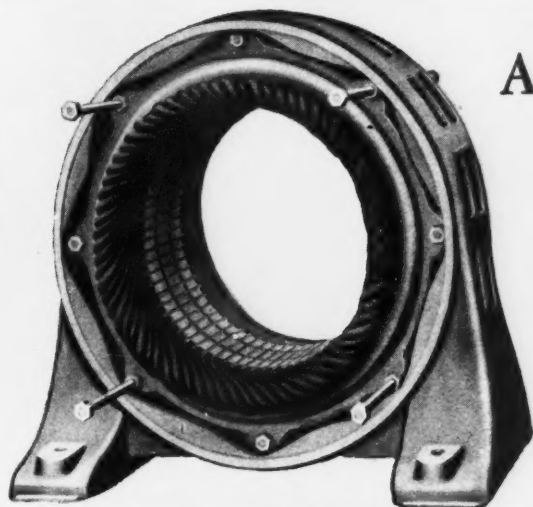


A Type XRE Compressor with the Patented I-R 5-step Clearance Control.

# Ingersoll-Rand

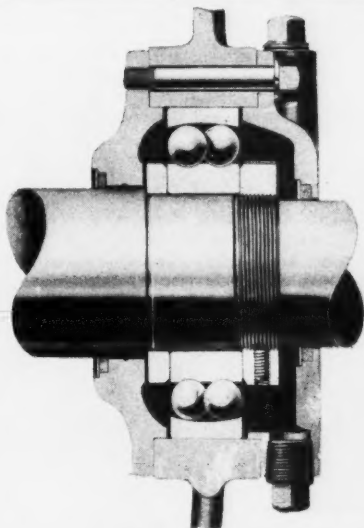
917-C

# TAKE AN F-M MOTOR APART..



## A rigid frame and substantial feet—

A rigid frame with good heavy end bonnets to give vibrationless support to the rotor and to protect the interior elements. Broad substantial feet to give a firm anchorage and to eliminate that weaving which is tough on bearings and shaft.

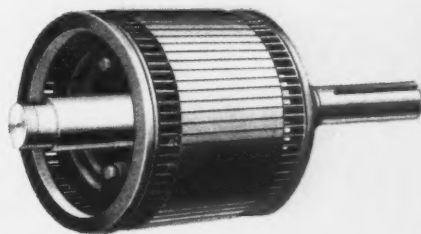


## ... and ball bearings

A feature pioneered by Fairbanks-Morse. A minimum, accurately maintained air-gap increases motor efficiency and power-factor. Grease packed ball bearings are used in F-M Motors not only for their better mechanical efficiency, but because they enable greater electrical efficiency. An F-M Motor requires lubrication but once a year. The bearings are enclosed in a dust-proof housing which retains the lubricant.



**GREASE ONLY  
ONCE-A-YEAR**



## End-rings and bars fused into a unit

Fairbanks-Morse cuts a groove in each end-ring to prove to you that the rotor bars are fused into the ring. No faulty or high resistance joints on an F-M Motor—the entire cage is a solid piece. The resistance value of the squirrel cage is there to stay—time and service cannot change it.

## A sturdy shaft withstands deflection

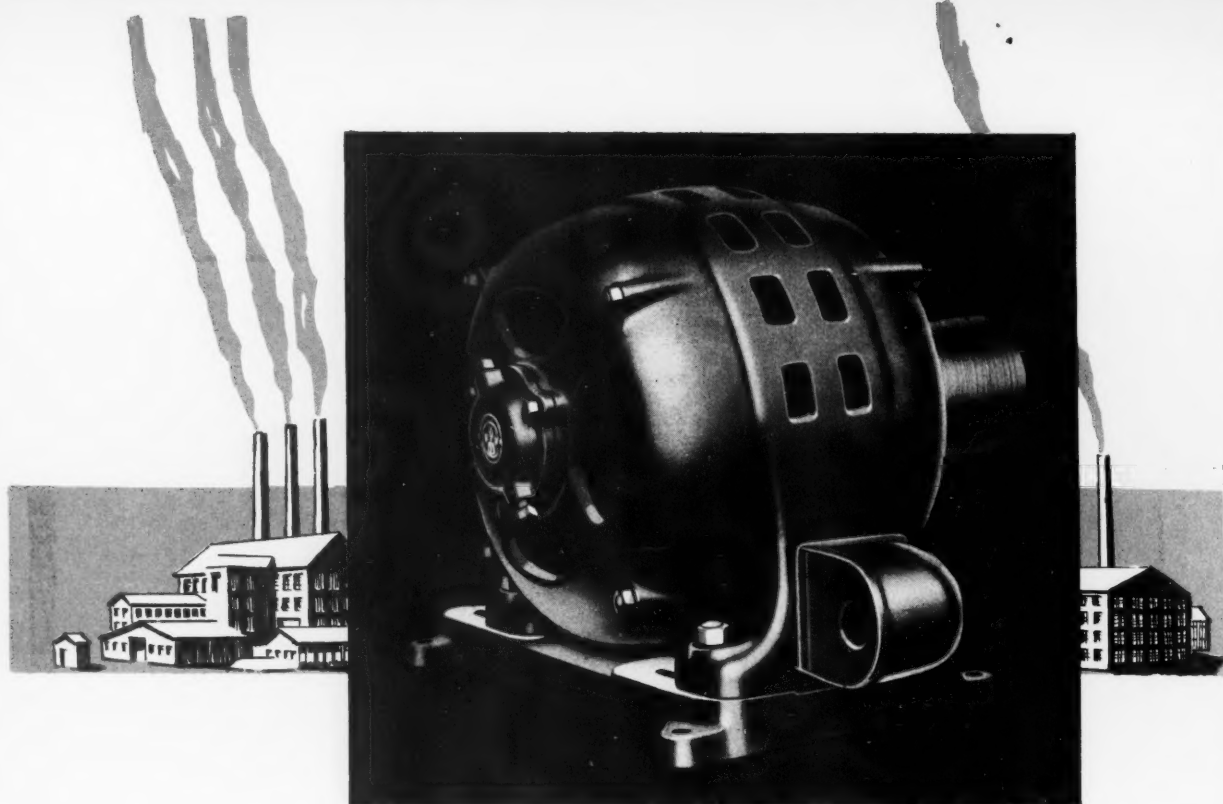
As short as possible, and *thick*, F-M Motors have shafts that take the torsional strains of starting heavy loads with least deflection. The shaft must move the load and Fairbanks-Morse fortifies its motors against the toughest service.

*The F-M Motor is a motor of features. You will have a professional interest in knowing its many advantages. A line from you will bring interesting literature describing F-M construction in detail.*

FAIRBANKS, MORSE & CO., Chicago  
28 branches at your service throughout the United States

# FAIRBANKS-MORSE MOTORS





## It depends on whether you buy *motors* or *performance*

If you regard a motor as just so much iron, steel, copper and brass—then buy the lowest priced motor you can get.

But if you regard the money you pay for a motor as an *investment*—and are looking for the highest returns in terms of *service* and *performance*—then first cost cannot be the main consideration.

You can buy motors for less than the first cost of a Fairbanks-Morse motor. But you cannot get more performance—more years of service per dollar invested.

For this motor is built without a single compromise to cost. Its first price is as low as a motor of its quality can be built—but the *performance* it must give is the first consideration of its makers.

Wherever wise motor buyers have looked beyond the price tag Fairbanks-Morse motors have proved their *over-all* economy.

Why not arrange for Fairbanks-Morse engineers to take up the matter of *low cost performance* with your organization.



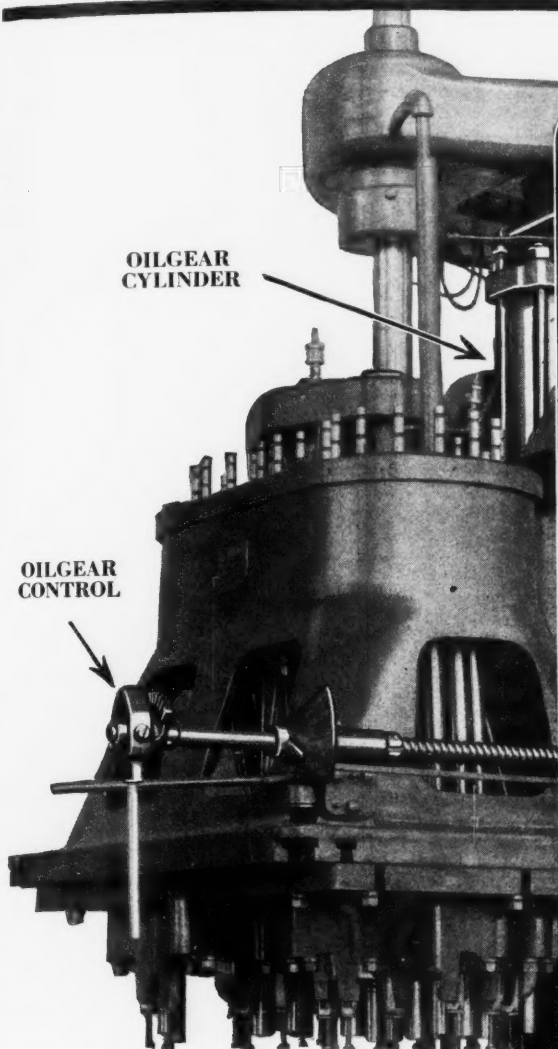
## FAIRBANKS-MORSE MOTORS



*Pioneer Manufacturers of*  
ball bearing motors

FAIRBANKS-MORSE MOTORS

# “The Oilgear Feed is a feature”



“The Oilgear Feed is the outstanding feature of the Natco C-16-H Heavy Duty Multi-Driller, giving simplicity of construction, high capacity, great flexibility and unusual ease of control and operation.” —from bulletin of National Automatic Tool Company, Richmond, Ind.

**W**HAT a difference an Oilgear Feed makes in the performance of a machine tool! The mechanical feed with “around a corner” shafting, speed change gears and bevel gears are replaced with a simple cylinder and piston and an Oilgear Pump. The Oilgear Feed is smooth and positive. There is no “wind-up”, backlash, or chattering. So smooth is the feeding pressure that in many instances the cutting speed can be doubled—and breakage is practically eliminated.

The Oilgear Feed gives a stepless speed range—the rate can be exactly suited to the individual job. Rapid advance and return, pre-set drilling speed and stopping can be controlled automatically if desired.

Machinery manufacturers have found in the Oilgear Feed a high production feature that gives a worthwhile sales advantage. Why not investigate the possibilities Oilgear offers your product?

The OILGEAR COMPANY

660 Park Street

Milwaukee, Wisconsin

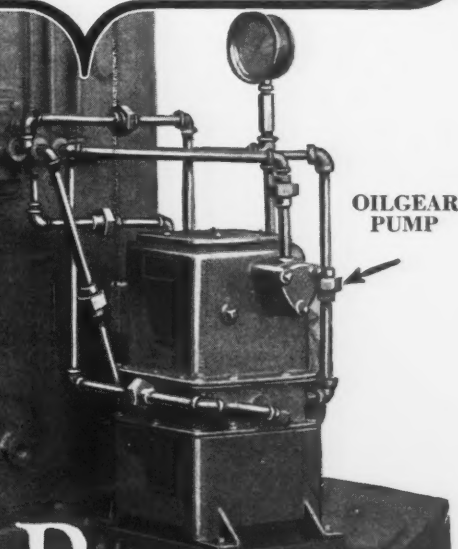


This registered trade-mark is on all Oilgear products for your protection. You can expect Oilgear performance only from equipment on which it appears.



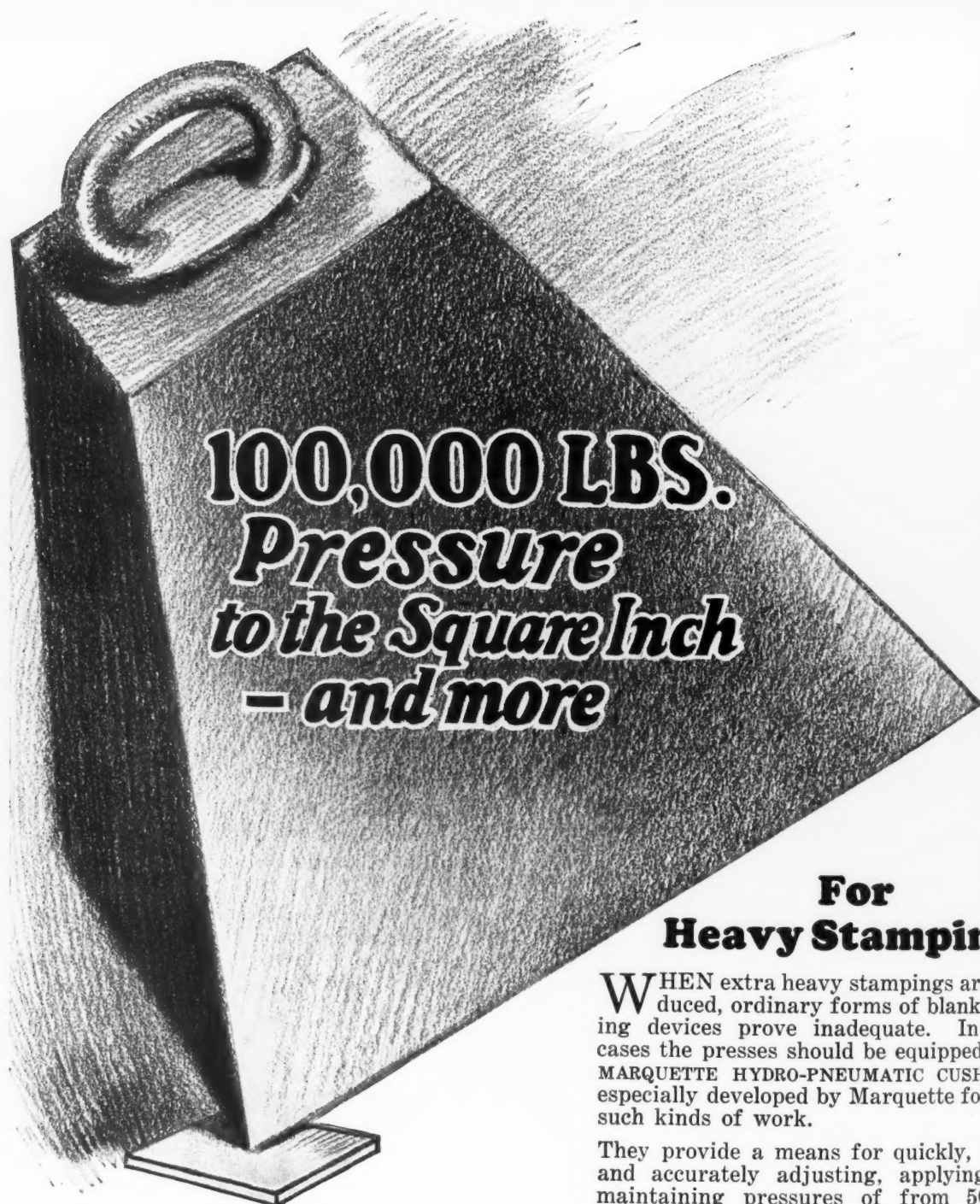
## OILGEAR

BROACHING MACHINES · PRESSES  
PUMPS · FEEDS · TRANSMISSIONS



OILGEAR PUMP

1985



**100,000 LBS.**  
***Pressure***  
***to the Square Inch***  
***- and more***

**For  
Heavy Stampings**

WHEN extra heavy stampings are produced, ordinary forms of blank holding devices prove inadequate. In such cases the presses should be equipped with MARQUETTE HYDRO-PNEUMATIC CUSHIONS, especially developed by Marquette for just such kinds of work.

They provide a means for quickly, easily and accurately adjusting, applying and maintaining pressures of from 500 to 100,000 lbs. (or more) to the square inch, with correct distribution of pressure to all parts of the blank.

They take up small space, are subject to no pressure loss, and cost practically nothing to operate. This Hydro-Pneumatic equipment is the latest addition to the useful family of



**MARQUETTE CUSHIONS**

Write for further information

**Marquette**  
**TOOL & MFG. CO.**

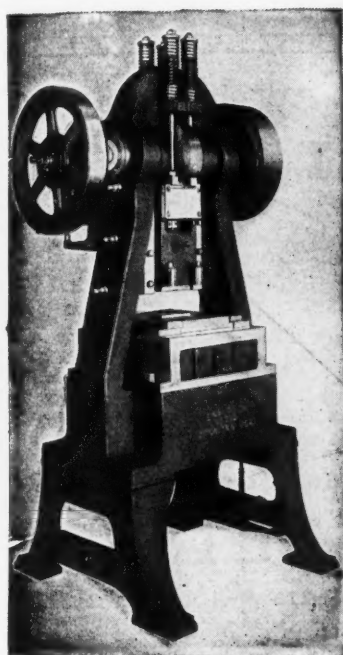
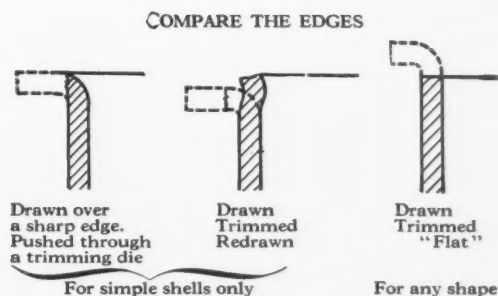
1904 N. KILBOURN AVE.



CHICAGO, ILLINOIS



A BETTER PRODUCT  
AT LESS COST  
AND WHY



Patented

A machine which opens new fields to designers of pressed metal parts.

## "Bliss" Flat Edge Trimmers

If you want a true "flat" edge, without grinding or filing,

If you want to trim notched or irregular edges in one operation,

If you want to trim accurately and hold to a depth,

If you want to achieve economy in trimming, on quantity production,

follow the lead of those large manufacturers who have already installed "Bliss" Flat Edge Trimmers.

When a nationally known concern comes back for more four times in a couple of years their appreciation of the machine is rather well demonstrated.

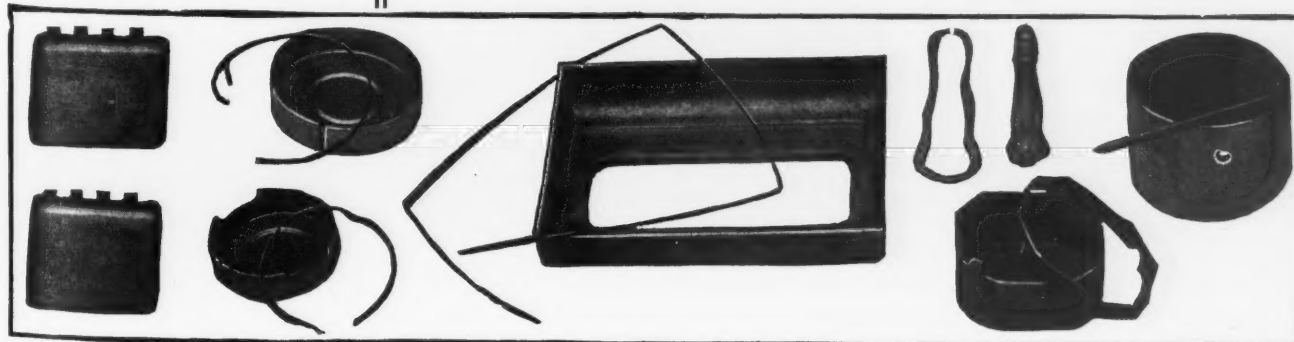
**BLISS** *for* **MACHINERY**

**E. W. BLISS CO.** BROOKLYN N. Y., U. S. A.

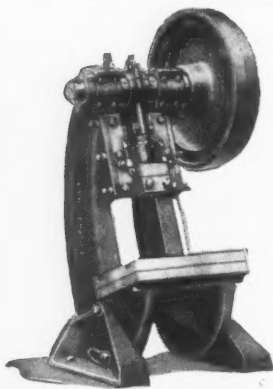
Factories: BROOKLYN, N. Y. HASTINGS, MICH. SALEM, O. CLEVELAND, O.  
Sales Offices: DETROIT CLEVELAND CHICAGO PITTSBURGH PHILADELPHIA  
ROCHESTER CINCINNATI NEW HAVEN

Foreign Factories and Offices: LONDON, ENG. TURIN, ITALY PARIS, FRANCE

# BLISS



No. 511



## LOW COST punch press work—with SAFETY!

Give your profits a chance to grow by doing all light work on light, fast Verson Presses, freeing big presses for work that really requires their capacity and power.

Verson Presses are attractively priced, operate at less expense, speed up production, are adapted to blanking, bending, forming as well as punching—and come equipped *without extra cost* with a

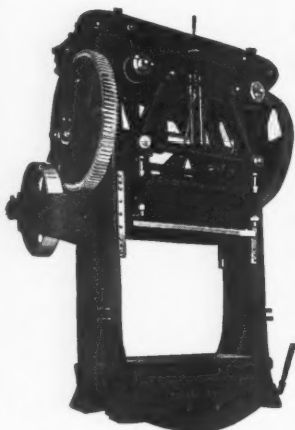
positive, automatic safety device, a safety type clutch that *cannot repeat* unless specially set to do so. *Write for full information.*

LA SALLE MACHINE WORKS, INC.  
3017 South La Salle St., CHICAGO, ILL.

Manufacturers of **Verson** Presses

## THE "TOLEDO" PRESSES FOR EVERY PURPOSE!

### Double Crank Toggle Presses



Patented

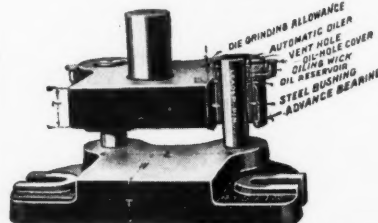
The Toledo Machine and Tool Company  
TOLEDO, OHIO

Chicago Office: 549 West Washington Blvd.  
Detroit Office: Room 3-258, General Motors Bldg.  
Engineers, Founders and Machinists on  
Equipment for Sheet Metal Products

The fine workmanship put into the making of "Toledo" Double Crank Toggle Presses results in smooth operation and perfect timing—dies last longer, maintenance expense is lower.

Made in sizes weighing up to 250 tons for all kinds of deep drawing, forming and stamping work. Let us supply details.

## Get Our New 120 Page DIE SET GUIDE



Listing  
70,000 Sizes

Select Your  
Own Standard

ONE OF OUR ENDLESS STYLES AND SIZES

### Baumbach Standard Automatic Oiled DIE SETS

Made of 25% Steel

The  
Product  
That Built  
Our  
Modern  
Plant



**E. A. BAUMBACH MFG. CO.**

GENERAL OFFICE & WORKS  
1810 South Kilbourn Avenue, CHICAGO, ILLINOIS  
Branch: 1627 West Fort Street, DETROIT, MICH.



## He Can't Get Hurt!

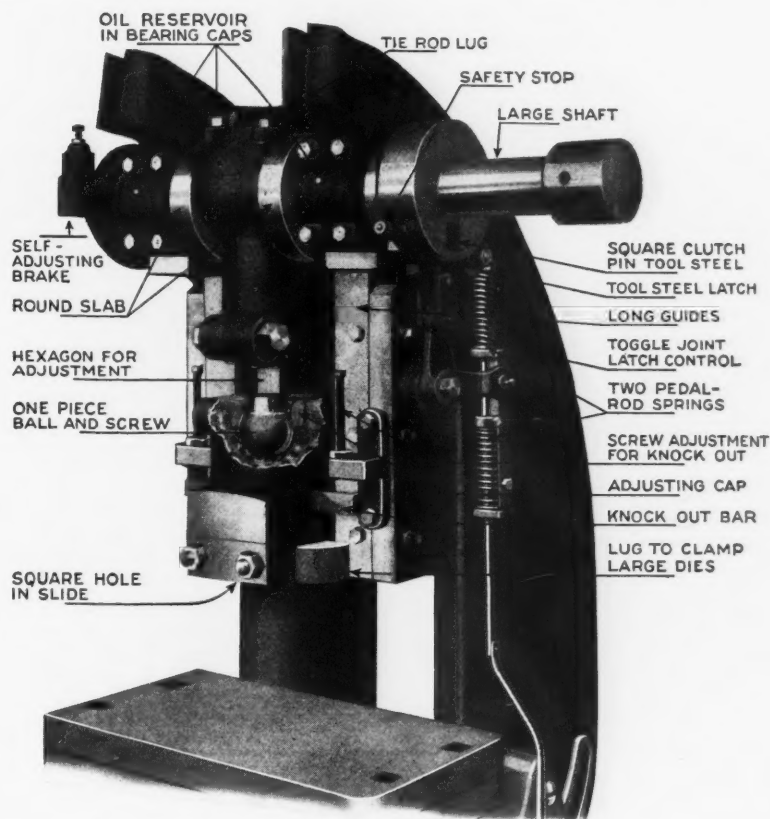
The operator—male or female, skilled or unskilled—is perfectly safe where D & M Junior Press Guard makes accidents impossible. This simple, convenient device sweeps the hand out of the way on the down stroke of the press; it does not interfere with production or press operation.

In making inquiries state make, stroke and size of press and whether left to right or right to left hand swing is desired.

**TAYLOR-SHANTZ CO.,**

485 St. Paul Street ROCHESTER, N. Y.

# Strength Means Economy



*Note Special Features on L-J Presses*

## — NOTICE —

We will pay \$100.00 for any new features suggested by you and adopted by us, that will add quality to our line of presses.

Years of specialization in building this one type of Punch Press accounts for the many outstanding and exclusive features found only in LOSHBOUGH-JORDAN INCLINABLE POWER PRESSES.

All L-J presses are now equipped with the New Shock Absorbing Latch, which practically eliminates the necessity of using the brake on a wide range of work—it also permits the use of higher speeds and reduces power costs to a minimum. This is an exclusive LOSHBOUGH-JORDAN feature.

*Let us quote you on your tool and die requirements.*

## Loshbough-Jordan Tool & Machine Co.

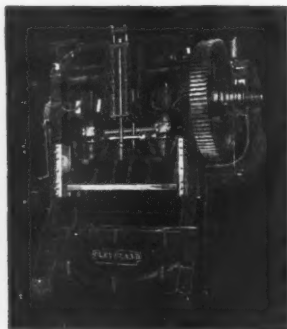
*Exclusive Builders of Inclined Presses for 16 Years*

**ELKHART**

**INDIANA**





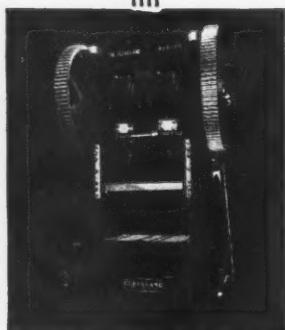
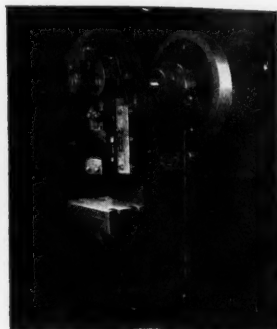


## CLEVELAND POWER PRESSES

"We wish to take this opportunity to advise you that in our selection of Punch Presses, Clevelands will receive as much, if not more, consideration than any others since we have been very well satisfied with Cleveland Presses as well as the service rendered on them."

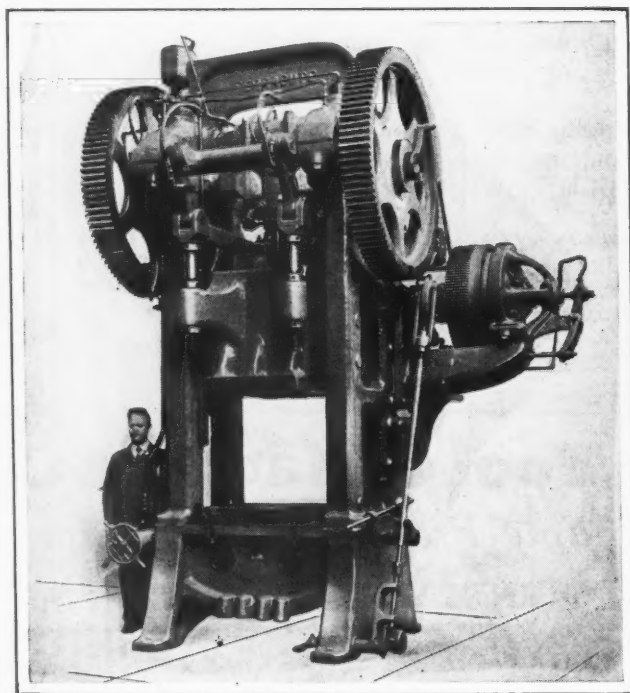
Cleveland Power Presses are built with the one idea in mind—that of service to the user. That's why we add a little more metal here and there—make the slides a little longer—allow a good factor of safety and reinforce them where the stress is greatest.

Whenever you require new additional Power Press equipment, get the specifications covering Clevelands and note these various features—you will find that Clevelands by reason of their rugged, accurate construction will give you a maximum of service with a minimum of up-keep.



# FERRACUTE PRESSES

For  
METAL STAMPINGS



The press shown is a modern, double-action, toggle drawing press, 150 tons pressure, tie-rod construction, with force-feed lubrication and friction clutch. Full information, with photographs, on request.

Presses for all purposes, geared or with heavy fly-wheel, with durable pin, jaw or friction clutches.

Sixty-five years' experience in designing and building presses.

Send us your press problems.

**Ferracute Machine Co.**  
Bridgeton, New Jersey

# POWER PRESSES

Heavy  
Duty  
Double  
Crank



*Rugged strength, compactness, heavy gearing and extra large bearings mark this heavy duty press by*

## NIAGARA

A TYPE and size of power press for nearly every sheet metal working need. Tell us what you have to shape from sheet metal and our engineers will recommend press of correct type and capacity—or send for free bulletins on type of press in which you are interested.

**Niagara Machine & Tool Works**

*Established 1879*

637-697 Northland Ave., Buffalo, N. Y.  
Philadelphia  
Harrison Bldg.

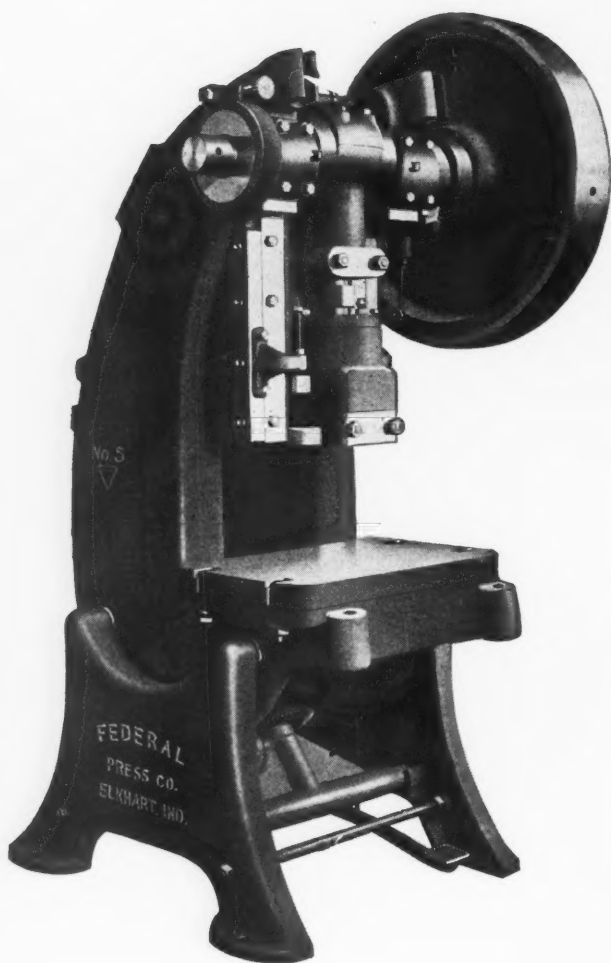
Pittsburgh  
Park Bldg.

---

PRESSES :: PUNCHES :: DIES :: SQUARING SHEARS :: ROTARY SHEARS

---

# FEDERAL PRESSES



**A** DEPENDABLE and complete line of Open-Back Inclinable Presses, sound in design and profitable in performance. They assure safety to dies, and low cost press production.

Send for circular containing detailed specifications.

**FEDERAL PRESS CO.**  
ELKHART, INDIANA

**DANLY**  
STANDARD

## DANLY DIE SETS have "IT"

Over 4000 makers of stampings use Danly Die Sets because:

Convenience, standardized, interchangeable die sets from stock.

Low first cost—save 20 to 50%.

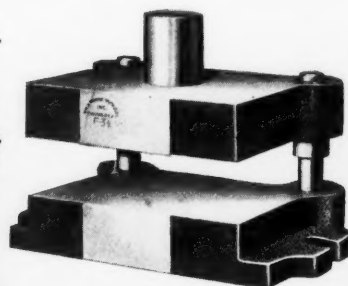
Shearing of dies is absolutely eliminated . . . enormous increase in "pieces per grind" and a very big reduction in the "depth per grind"—because of hardened, ground and lapped leader pins and bushings.

Cut die maker's time for mounting dies and set-up on press 50 to 80%, because of leader pins and because all working surfaces are accurately machined.

Eliminate bother, delay, previous planning and detail and frozen capital . . . immediate delivery from stock from nearest warehouse.

**You, too, can save by using Danly Die Sets and Die Makers' Supplies.**

*Send for New Danly Catalog, 5th edition, 100 illustrations and blue-prints, a valuable treatise for every executive, purchasing agent, designer, tool room foreman.*



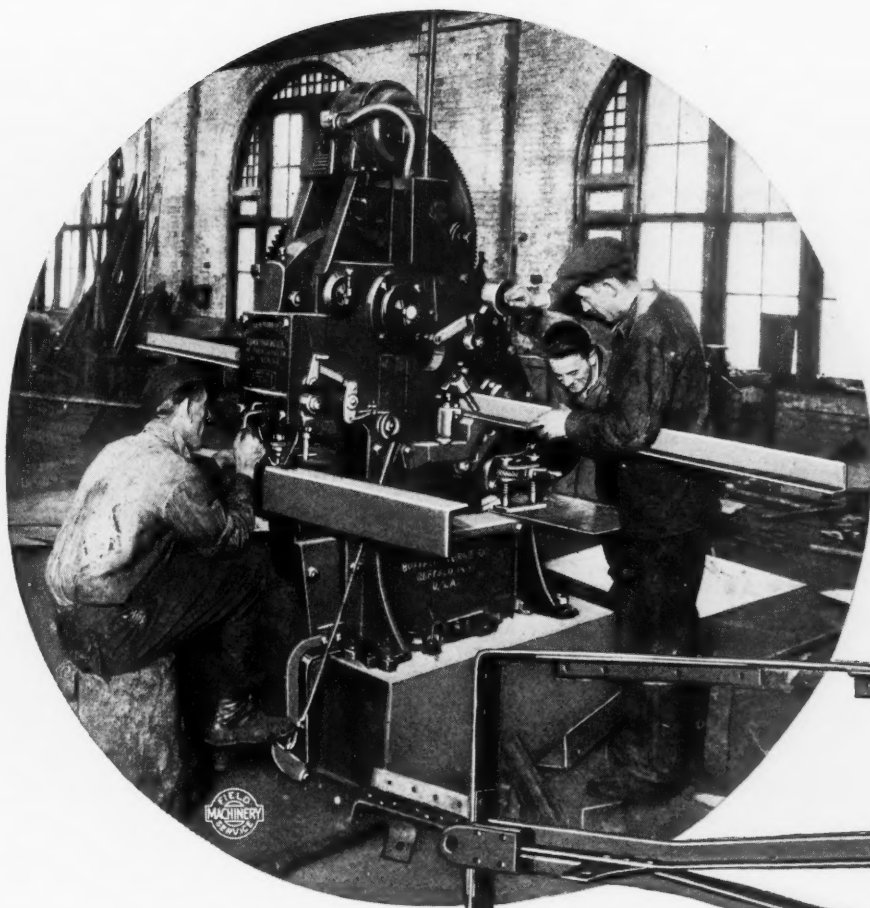
*Semi-steel punch holders and die shoes or steel shoes with semi-steel holders, a size and type for every need . . . in stock.*

**DANLY MACHINE SPECIALTIES, INC.**  
2104-2130 SOUTH 52<sup>ND</sup> AVENUE, CHICAGO.

DETROIT, MICH.  
1537 TEMPLE AVE.,

LONG ISLAND CITY, N.Y.  
36-12 34<sup>TH</sup> STREET





**"Buffalo"**

The Scheid Eng. Corp. manufacture coal and ash handling equipment, structural steel work, trailers, trucks, etc. This is a truck body frame, the angle iron and flat stock of which is cut and punched on the Buffalo Universal Iron Worker—which, incidentally, is used 48 hours a week.



## Here's Work Capacity!

—handling three jobs simultaneously is all in the day's work to a Buffalo Universal Iron Worker.

This picture, taken in the Brooklyn, N. Y., plant of the Scheid Engineering Corp., gives a good idea of the versatility and handiness of a No. ½ Buffalo Universal Iron Worker.

One of the men is shearing ¼" thick plate, another cutting-off 3" x 3" x ¼" angle iron, and the third punching ¾" holes in 3" x 5" x ½" angle iron. This is only a fraction of the tool's capacity. Its natural range is unusually wide; with special tools it can be used profitably on almost any job in the shop.

Most plants consider their Universal Iron Workers the most profitable investment in their equipment. Write us about your work and let us show how one of these sturdy machines can earn for *you*.

**Buffalo Forge Company, 144 Mortimer St., Buffalo, N. Y.**

In Canada: Canadian Blower & Forge Co., Ltd., Kitchener, Ontario.

# Hydraulic and Hydro-Pneumatic Straightening Presses

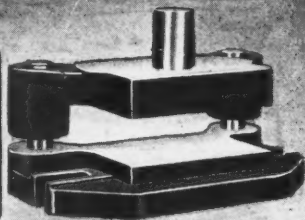
In Capacities of from 10 Tons to 200 Tons

METALWOOD MFG. CO. 3358-3366 Wight Street, DETROIT—MICH.

## U.S. TOOL

### SUBPRESSES (DIE SETS)

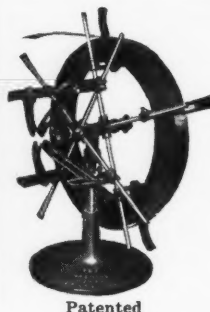
Made in a wide variety of styles and sizes to meet most any die holding requirement. It will pay you to send for complete details and prices. A card will do.



### Distributors

F. C. DANNEMAN CO.,  
173 Lafayette St., N. Y. C.  
PORTER ELEC. MACH. CO.,  
2401 Chestnut St., Philadelphia, Pa.  
KLOEPPER COMPANY,  
3331-33 Rutger St., St. Louis, Mo.  
FRED H. MURPHY,  
26 Melrose Ave., Bridgeport, Conn.  
OSCAR LORANGE CO.,  
830 Old South Bldg., Boston, Mass.  
LEONARD R. NOURIE,  
Park Bldg., Pittsburgh, Pa.  
J. R. BELL,  
512 W. Queen St., Inglewood, Cal.  
KEMP MACHINERY CO.,  
211 President St., Baltimore, Md.

U. S. TOOL COMPANY, Inc.  
MANUFACTURERS AND ENGINEERS  
AMPERE (Newark) N. J.



Patented

Quick **S&S** Loading

DOUBLE SWIVEL REELS  
for use with roll feeds, etc.  
SINGLE INCLINABLE REELS  
for hand feeding.  
HORIZONTAL REELS  
for round wire.  
DISC REELS  
for brass, copper, etc.

### S & S MACHINE WORKS

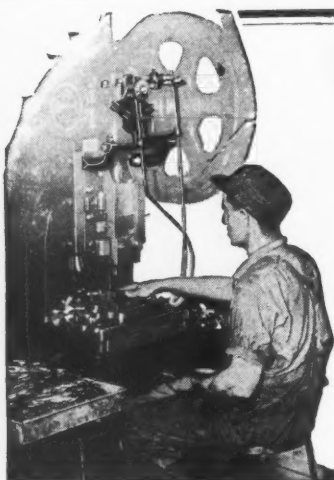
4541 W. LAKE STREET

CHICAGO, ILL., U. S. A.



PRESSES—Foot and Power.  
WIRE FORMING MACHINES—Standard and Special.  
TUMBLING BARRELS—All kinds.  
BALL BURNISHING EQUIPMENT.  
AUTOMATIC CHUCKING MACHINES.  
THE BAIRD MACHINE CO.  
BRIDGEPORT, CONN.

**V & O POWER PRESSES**  
Automatic Feeds  
Automatic Threading Machines  
The V & O PRESS CO., Hudson, N. Y.



## Increased Confidence—Increased Production

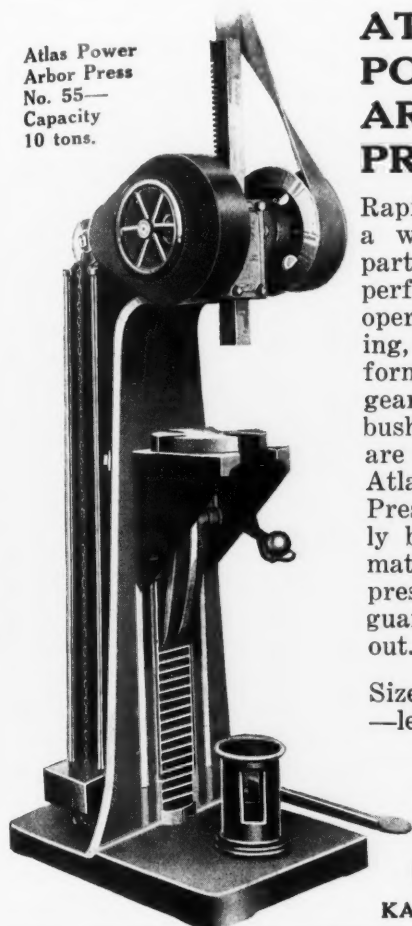
**The Wiesman Safety Punch Press Guard** sweeps the full length of the bolster plate on half of the downward stroke—entirely automatic, no button or lever to press.

The Wiesman Guard does not interfere with operation, entirely out of the way for fast feeding.

The operator works faster because free from fear of accidents, and increased production means more profit. No adjustments to make—quickly attached. Illustrated circular gives full description of the guard. May we send it?

**Wiesman Manufacturing Company, Dayton, Ohio**  
31 to 35 South St. Clair Street

Atlas Power  
Arbor Press  
No. 55—  
Capacity  
10 tons.



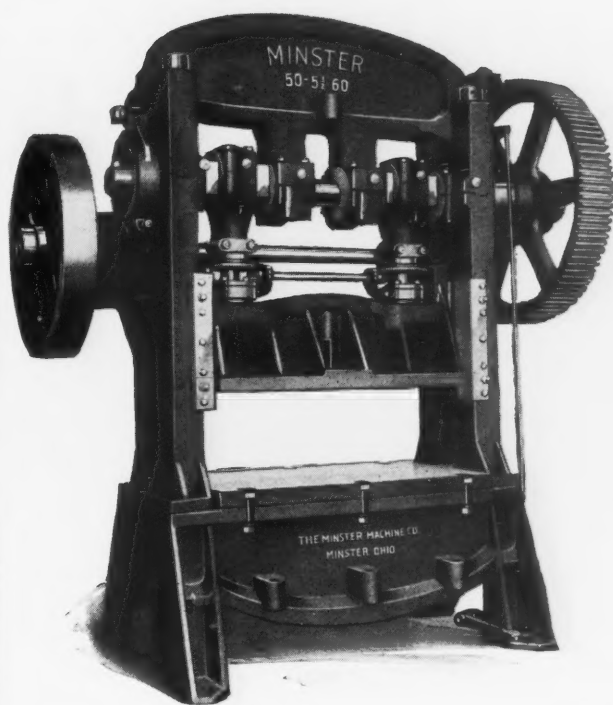
## ATLAS POWER ARBOR PRESSES

Rapid production of a wide variety of parts—the speedy performance of such operations as bending, straightening, forming, assembling gears, pushing in bushings etc.—these are jobs at which Atlas Power Arbor Presses excel. Finely built of selected materials by arbor press specialists—guaranteed throughout.

Sizes for every need  
—let us send details.

**ATLAS  
PRESS  
COMPANY**  
KALAMAZOO, MICH.

# Minster Power Presses



## What is Your Problem?

Write for prospectus listing the Pexto big line of Hand and Power Machines for facilitating sheet metal working operations—Then check the Bulletins of interest. Let our Engineers help solve that problem.

**PUNCHING  
WIRING and  
SEAMING  
PRESSES**



**DIES  
a  
Specialty**



**THE PECK, STOW & WILCOX CO.**  
SOUTHLINGTON, CONN., U. S. A.

Are the result of extensive research work, advanced ideas on designing and efficient manufacturing methods.

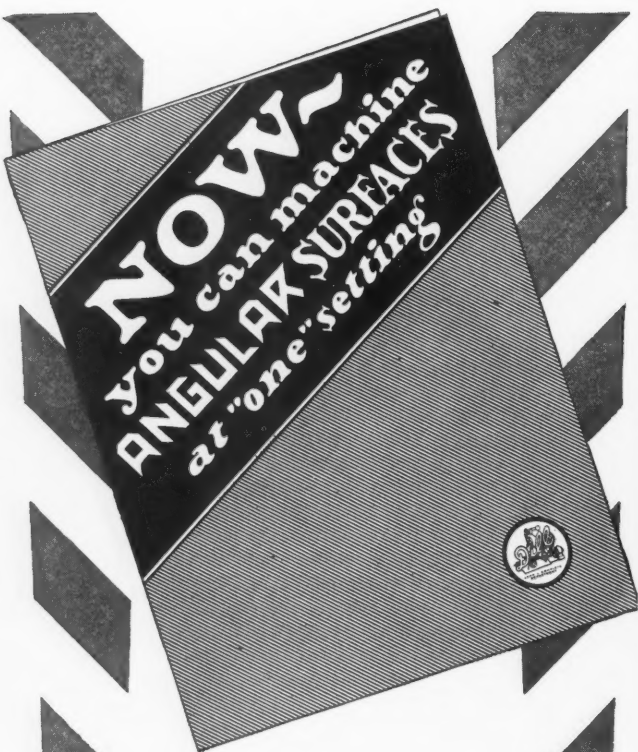
Frame castings are figured with minimum deflection—assuring long life of dies.

## THE MINSTER MACHINE CO.

**Minster, Ohio**







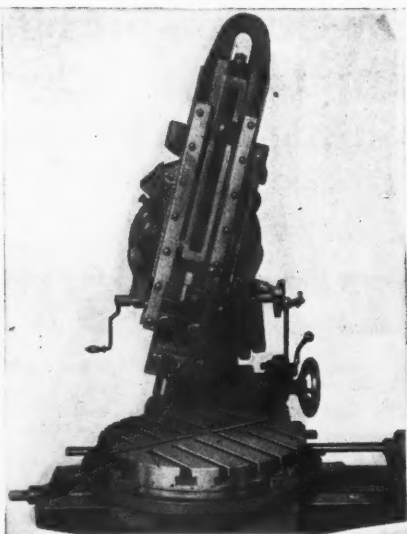
## Bulletin on Request

WE have just prepared a bulletin which fully describes the Universal (swivel) Traveling Head feature of the Dill Slotter. This feature permits the machining of angular surfaces 15 degrees on each side of the vertical center line of the cutter head. This machining is accomplished with the same accuracy and speed as straight surfaces and requires only "one setting." Write us today for this bulletin,—no obligation.

### Nazel Engineering & Machine Works

4043 N. 5th Street, Philadelphia

Also builders of the Nazel Air Driven Forging Hammer



## PIPE THREADING ECONOMY

will pay large dividends and the possibility of obtaining these savings in your plant should be investigated.

- 100% Dividends in many cases. (Yearly)
- 80% Saving in time over old methods.
- 75% Saving in Floor Space.
- 50% Saving in Power.
- 25% Saving in Labor.

SEND FOR THE FACTS



HAND - BELT - ELECTRIC MODELS

Portable 2, 3 and 4 Inch  
Others 6, 8, 12 and 16 Inch

THE *Curtis*

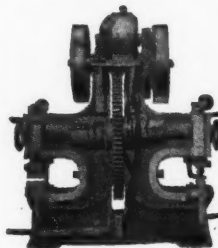
AND CURTIS CO.

Pipe Cutting and Threading Machines

324 Garden St., Bridgeport, Conn.

Find out about wide dies

PORTABLE 3 INCH ELECTRIC



*Royersford Tumbling Mills are distributed by New Haven Sand Blast Co., New Haven, Conn., and Cleveland, O., as sole agent*

## ROYERSFORD Punches and Shears

"Sells" Roller Bearings.

Commercial Roller Bearings.

Power Transmission Machinery.

Excelsior Drills 10", 14", 20".

Roller Bearing Tumbling Mills  
(Roller Bearing throughout)

The

Royersford Foundry & Machine Co., Inc.

Box M Royersford, Penna.

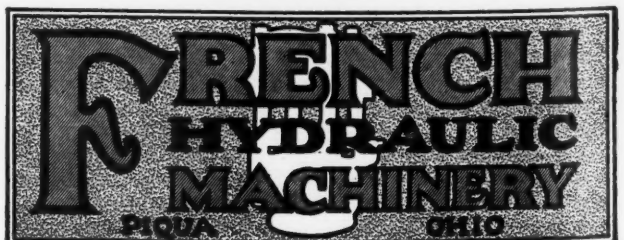
## Hurlbut, Rogers Cutting-off Machines

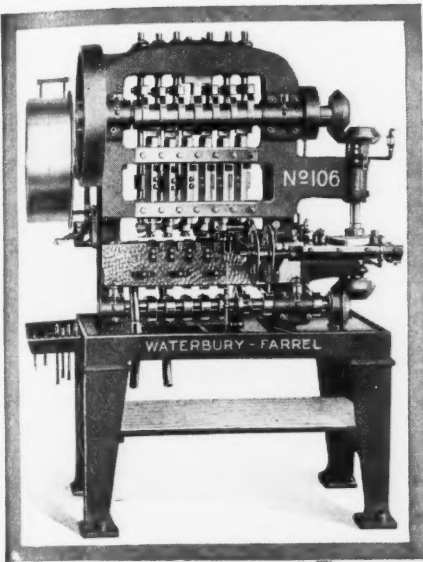
Have patented features found in no other machines; speeds and feeds to suit all metals. Capacity to 10" stock.

Write for catalog

THE HURLBUT, ROGERS MACHINERY CO.

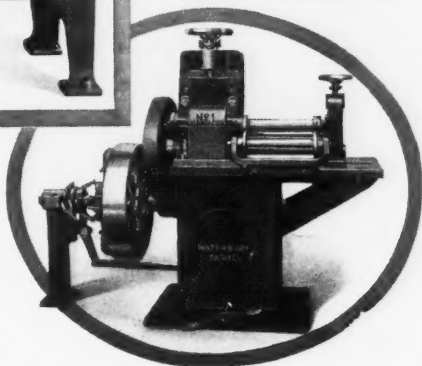
Nashua, N. H.





Standard 6-Plunger Eyelet Machine. Eyelet Machines are built in 7 sizes, each with from 4 to 10 plungers.

RIGHT — 12" Gang Slitter. Slitters are built in 6 standard sizes; also special heavy and light machines and trimmers.



## WATERBURY-FARREL EYELET MACHINES

or Multiple Plunger Presses are especially intended for the manufacture of that countless array of small articles of the class typified by radio and other electrical appliance parts, camera and typewriter parts, shells, fasteners, etc.

**Distinctly Quantity Production Machines.** The strip metal feeds in automatically at one end and the finished article drops out of the other. Maximum blank diameter  $3\frac{3}{4}$ " ; 4 to 10 plungers.

**Operation.** The stock passes over a lubricator and is fed to the blanking die by the feed rolls. The blanks are successively and rapidly transferred to the other dies where the operations of drawing, forming, piercing, etc., are performed.

GOOD COMPANIONS

## GANG SLITTING MACHINES

Strip metal for Eyelet Machines, or in fact for any roll feed press, must be of uniform width. Slitting Machines, equipped with a gang of rotary cutters, are employed in the cutting-up shop for cutting metal of commercial widths into the exact widths required. These machines are also used in the rolling mill for trimming the rough edges of rolled sheets.

## The Waterbury Farrel Foundry and Machine Company

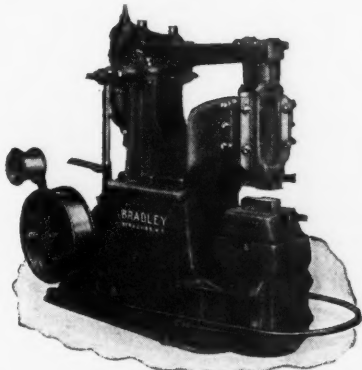
Builders of Power Presses and Machinery for Making Bolts, Screws, Nuts, Wire, Rod, Tubing, Strips and Sheets

Home Office and Works: WATERBURY, CONN.

Western Sales Office: CLEVELAND, OHIO

## LONG HOURS

of ceaseless pounding year in and year out never detroys the perfect alignment of



### THE BRADLEY UPRIGHT HELVE HAMMER

Write for complete details

**C. C. Bradley & Son, Inc.**  
Syracuse, N. Y.

ESTABLISHED IN 1832

Makers of

The Bradley Cushioned Helve Hammer. The Bradley Upright Helve Hammer. The Bradley Upright Strap Hammer. The Bradley Compact Hammer. Heating Forges for Hard Coal or Coke.

## THE HIGH SPEED RIVETING HAMMER

(Patented)

COLD RIVETING, STRONG SOLID HEADS, RAPID PRODUCTION



Nine sizes to handle rivets from  $1/64$  to  $1\frac{1}{2}$  in. in diameter

Send samples to be riveted for your approval  
Write for Catalog "C"

**THE HIGH SPEED HAMMER CO., Inc.**

305-321 Norton St.,

ROCHESTER, N. Y., U. S. A.



**"If ever a set of dies has shown its mettle, this set has—"**

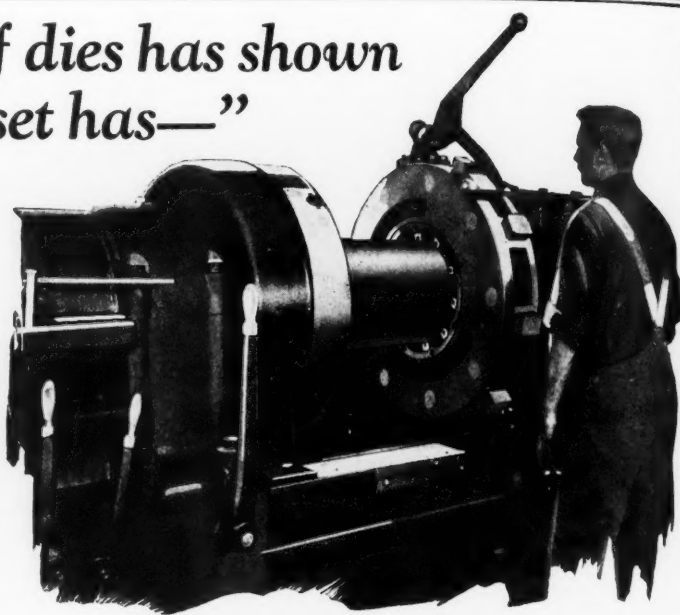
Remarkable savings in die costs are reported by the same owners who are getting 40% to 60% increases in threading production by using the WILLIAMS "Rapiduction" machine.

These savings run into "real money," as shown by reports from one Rapiduction user after another. For instance, here's one from an owner in Wisconsin. They write us:

"Since placing this set of 2½ to 6-inch dies in our machine they have cut 786-2½-inch threads; 574-3-inch; 163-3½-inch; 323-4-inch; 11-4½-inch; 147-5-inch; 141-6-inch threads. A total of 2,145 threads, without once grinding the dies or taking them from the machine!

"We believe this is a record not often duplicated by one set of dies—they have more than stood the gaff, and certainly deserve a regrinding." (Name and address on request.)

**WILLIAMS  
RAPIDUCTION**  
PIPE, NIPPLE AND BOLT THREADING MACHINE



**You get much faster threading—at lower cost—with the "Rapiduction"**

It's a machine that gives you much more Speed—and is built to stand its faster pace, month after month.

Saves time on set-ups: Only one die head, for the entire range of the machine. And the only time it's necessary to change dies is when you want to cut threads of another pitch.

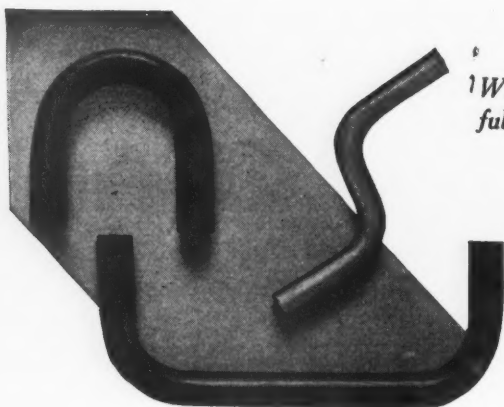
Write for Bulletin "O" describing the WILLIAMS "Rapiduction."

**Williams Tool Corporation**  
Erie, Pa.

## Speed Up Your Pipe Bending By Using a Pedrick

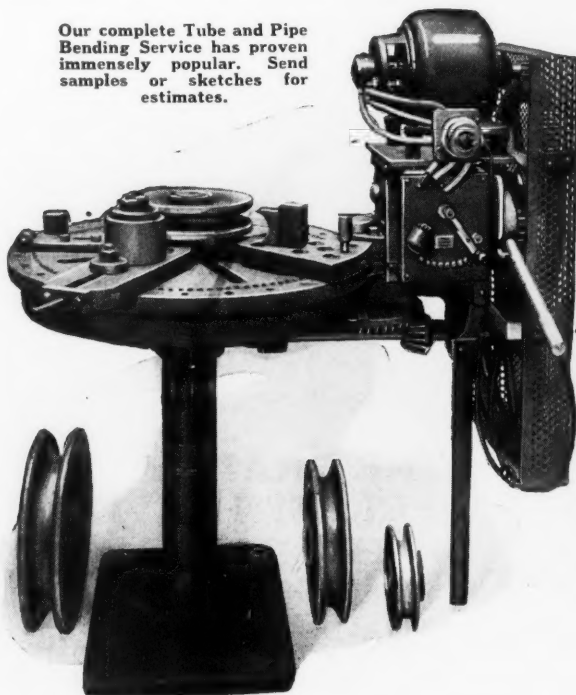
Pedrick Pipe Benders have simplified one of the most difficult and expensive jobs found in the average shop. They produce regular or irregular bends, including full "U"s (180°), in any cold metal, eliminating all the usual crinkles, cracks and distortions, even on galvanized coatings.

Made in 2 sizes, 1" and 2" capacity, hand or motor driven, Pedrick Pipe Benders are simple to operate and sturdily made. They are indispensable in any shop that bends pipe.



Write for full details.

Our complete Tube and Pipe Bending Service has proven immensely popular. Send samples or sketches for estimates.



**PEDRICK TOOL & MACHINE CO.**  
3639 N. Lawrence St., PHILADELPHIA, PA.





## Let's Go All The Way



There are four distinct steps in the development of special tools for cutting threads.

- First — The Hand Stock.** This method wastes time and lessens the workman's efficiency.
- Second — The Power Drive for hand stock.** This is one better, but very slow and inefficient.
- Third — The Light Power Machine.** This is all right as far as it goes, but it fails to give maximum production and the machine generally gives out and must be replaced in a few months or years.
- Fourth — The Heavy Power Driven Machine** that will give 100% efficiency and stay on the job indefinitely.

Let's not waste time and money experimenting, but let's go all the way. Thousands have profited by consulting Pipe Threading Machine Headquarters—Will you be next?

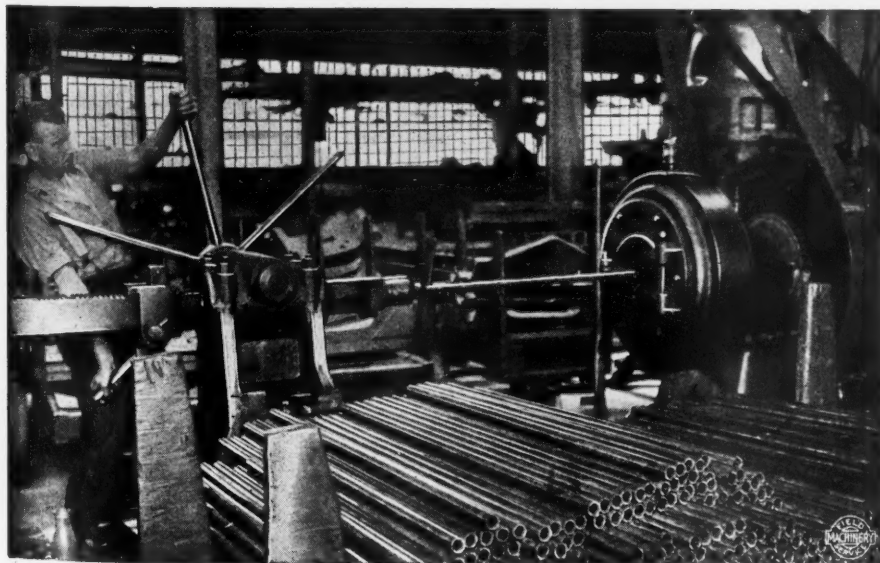
**Signall & Keeler Machine Works, of the N. O. Nelson Mfg. Co.**

EDWARDSVILLE, ILLINOIS



## ETNA SWAGERS

*Produce Accurate Work on a Paying Basis*



AN output of two hundred steel tubes swaged to an even  $1\frac{1}{8}$ " diameter overall, from each of four Etna Swagers enables a western manufacturer of automobile chassis frames to maintain production with plenty to spare. The tubes are used for automobile tie rods, and uniform diameter is important.

Etna Swagers are giving satisfaction on a wide range of swaging work in leading plants everywhere—and can always be depended on to keep going with few repairs, and to produce at low cost.

*We would like to send you some typical Etna production figures—or estimate on your own work. Write us.*

**THE ETNA MACHINE COMPANY**

Maplewood Avenue and Castle Boulevard

TOLEDO, OHIO

# DIE SINKING—ENGRAVING

## The Gorton 3 X—for deep or Delicate Work

The Gorton 3 X Universal Die-Sinking and Engraving Machine is a highly accurate precision tool with a working range from heavy cuts on steel dies to minute and delicate lettering.

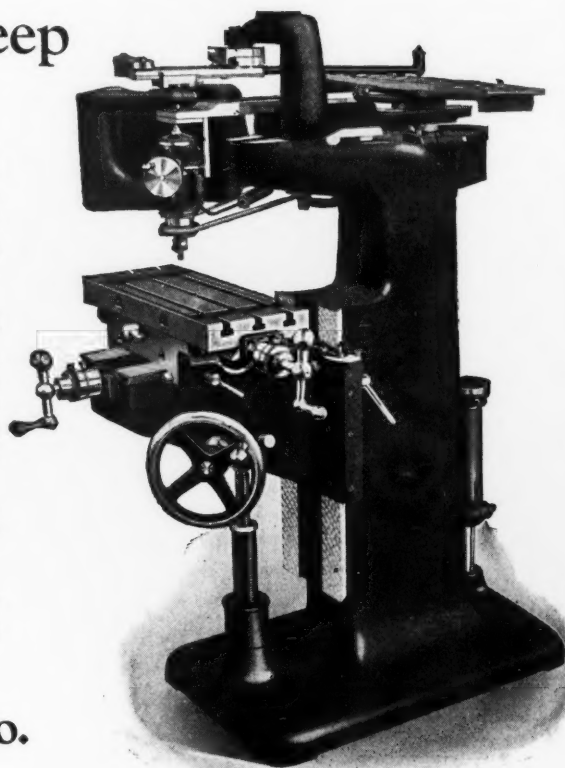
Exclusive patented features include ball bearing construction (24 accurately aligned, dust-proof bearings), positive cutter stop, accurate to 1/10,000" on the spindle, improved feed works with feed thread hardened and ground, improved ball bearing drive, etc.

Made to handle any work to discs 5" thick, 36" diameter, to drums 13" high, 26" diameter.

If you do die sinking or engraving of any kind, in any metal, get details of this machine and the remainder of the Gorton Line.

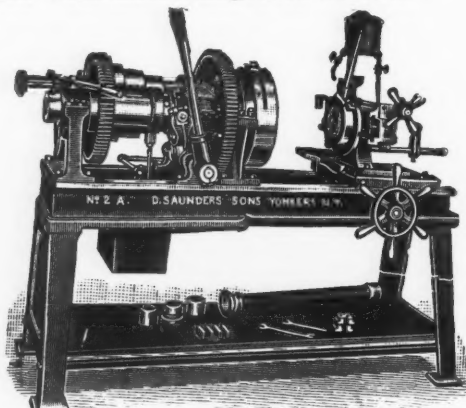
**George Gorton Machine Co.**

Racine, Wis., U. S. A.



## Thread the Saunders' Way

Saunders' pipe threading and cutting machines reduce costs by reducing operating time. Production machines that pace the busiest shops without in any way sacrificing accuracy, they are unequalled in range, dependability and modernity of design. Made in motor or belt driven models, 1/4" to 4" inclusive, equipped with lever gripping chucks and new type adjustable expanding die-heads with interchangeable chasers.



No. 0 range 1/8 to 3/4" incl No. 2-A range 1/4 to 2" incl  
No. 3-F range 1/2 to 3" incl No. 4-C range 1 to 4" incl

*Circulars Sent Upon Request*

**D. SAUNDERS' SONS, INC.**  
YONKERS, N. Y.



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No. 7 Hotswaging Machine—Dies 6 in. long—Hydraulic work holding and feeding attachment. The range in capacities of these machines is from a pin point to 4 in. solid stock and 6 in. tubing. In producing circular sections straight, reducing, pointing and tapering round, square, hexagonal and similar shaped rods and tubes. We specialize in the design and building of holding and feeding attachments, operated pneumatically, hydraulically or by hand. One of the main features of the Swaging Machine is its operation by unskilled labor as there are no delicate adjustments or complicated tool set-ups. Samples or Blueprints will bring Complete Details.



**LANGELIER MFG. COMPANY**

Arlington, Cranston, R. I.

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American Broaching machines and Broaches—built to make this important operation pay real profits. Investigate.

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PIPE THREADING for BETTER threads MACHINES

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## Often Returns Its Cost On First Job

The average machinist's hourly wage is just about equal to the retail price of a Walton Tap Extractor. And as these handy devices, in a few minutes' time, often save a full hour of labor on their very first jobs, the return of the slight investment is immediate—and the upkeep cost nothing.

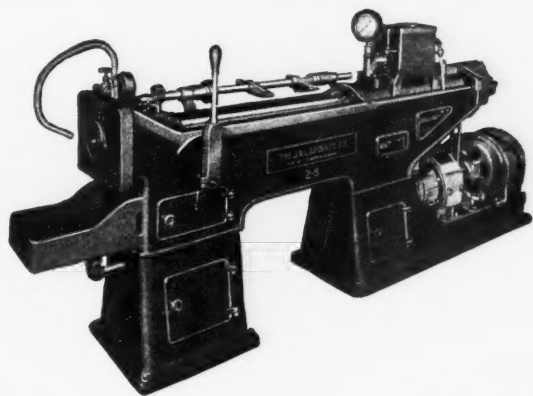
Walton Tap Extractors not only save workmen's time, but in many cases an entire job, for they remove taps without injuring the thread. They are made for all sizes of 3 and 4 fluted taps, and for special jobs.

*Circular upon request. Or, if you prefer, an Extractor on 60 days' trial.*



**THE  
WALTON CO.**  
310 Pearl St.  
Hartford, Conn.

## The Walton Tap Extractor



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A machine must "have something" when it can increase production on its particular job by 50% to 250%—*wherever installed*. This is the record established by J. N. Lapointe Co. broaching machines—90% efficient units.

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**I**f you have a heavy-duty machine tool that literally "burns up" the usual high-speed tool-steel, try Gold Star—the new super-cutting steel especially designed by Carpenter for this express purpose.

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Gold Star is obtainable in treated bits and annealed squares and flats in all standard sizes. Descriptive circular sent upon request, or consult our nearest district office.

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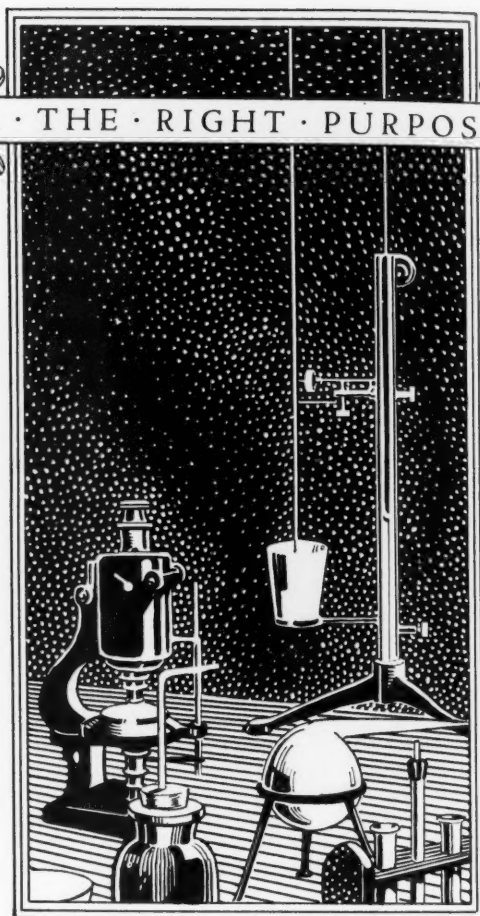
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**H**YMO Steel fills the wide gap between Bessemer screw stock and S. A. E. 1020---offering the combined qualities of these steels and avoiding all of their disadvantages.

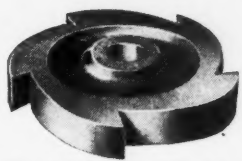
For case hardened parts, it absorbs carbon faster than S. A. E. 1020, leaving a tougher and more ductile core.

The adoption of Hymo Steel has progressed to wide proportions throughout many industries.

UNION DRAWN STEEL CO. - *Beaver Falls, Pa.*

UNION  DRAWN  
STEELS

# Made of AMSCO Manganese Steel

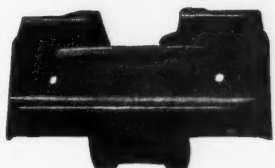


A Ratchet of Amsco Steel for a sandcutting machine, long life assured.

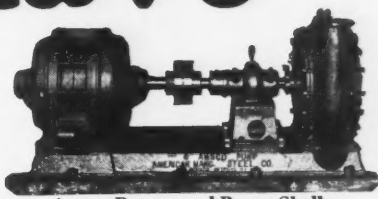


Gears and Pinions, all sizes and styles, for constant duty where loads are heavy. Amsco made.

they have



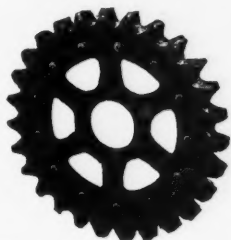
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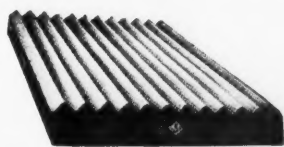
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longer  
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Amsco Made Front Idlers for Holt and Best Tractors eliminate breakdowns, and save time and money.



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Use Amsco Buckets for long wear. Made in all sizes and shapes to suit every need.

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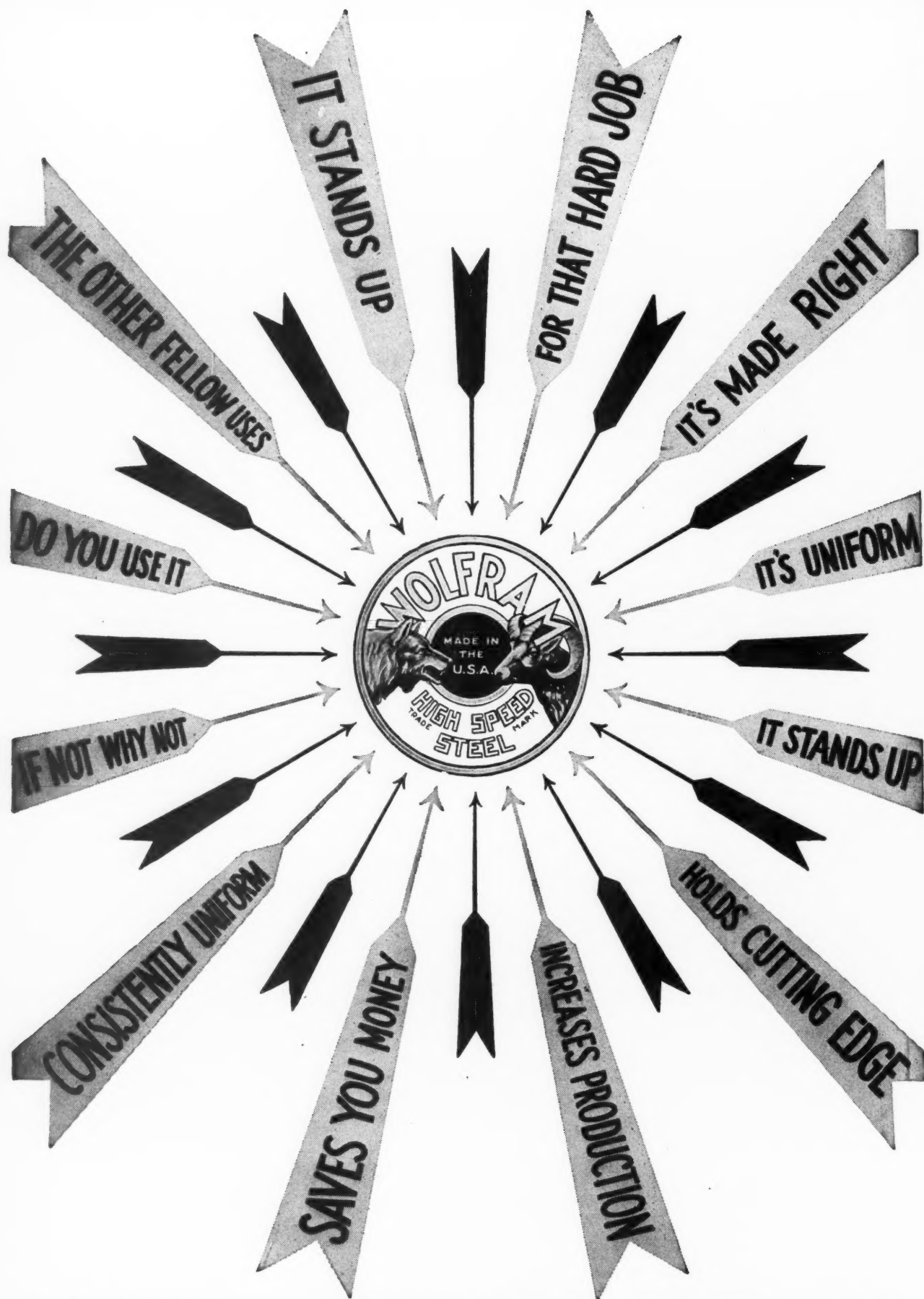
## AMSCO

AMERICAN MANGANESE STEEL COMPANY

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STEEL CO.  
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*Make a comparative test  
with the steel you are now using*

Out of fairness to yourself, you should investigate the merits of Carnegie Manganese Steel—an open hearth steel recently developed to satisfactorily answer our customers' needs for a high grade steel at a comparatively low price. It is made in two grades. The grade for screw stock or threading steel contains manganese of 1% and over and sulphur of 1/10 of 1% and over. These elements confer on basic open hearth steel the qualities you have long been looking for in screw stock—a steel that is tough, easily machined, forged and heat treated. The other grade is for forging purposes, and responds to heat treatment in a manner similar to the more expensive steels, such as 3½% nickel and low nickel chrome steels. The manganese content of about 2% not only confers excellent heat treatment properties, but the steel shows a considerable improvement in physical qualities in the hot rolled condition over plain steels of the same carbon content. These new steels are already solving many executives' production problems on a quality basis. Our Metallurgical Department is always at your service and will gladly cooperate with you on any problems involving your steel requirements. Take advantage of this service.

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*General Offices — Carnegie Building*  
**PITTSBURGH, PENNA.**

1928

# HAWKRIDGE BROS. STEEL SERVICE

You know that the steel you need for that troublesome job is on the market—the difficulty is, to find it without long and costly research.

The answer is contained in the quality and extent of Hawkridge Bros. Steel Service—in which metallurgists and steel service experts are ready to consult with you on your "problem" job; to recommend from the comprehensive Hawkridge line the steel experience shows is best and to see that you get it—without variation—as often and as long as you need it.

*Tell us what steel you need  
—trust us to find it. Get  
acquainted with Hawkridge  
Steel Service.*

## HAWKRIDGE BROS. COMPANY

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## ANNOUNCING

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## CROMOVAN

## TRIPLE DIE STEEL

An improved high-carbon-high-chromium alloy in which we have overcome the common fault of this type—resistance to machining in the annealed state—without sacrificing any of the ultimate hardness after final heat treatment. . . . .

In CROMOVAN TRIPLE DIE STEEL we offer two useful features to an outstanding degree:

1. Machinability in the annealed condition. The ANNEALED CROMOVAN TRIPLE DIE STEEL has a maximum hardness of 210 Brinell, 35 Scleroscope (Shore Model C), 97 Rockwell B or 23 Rockwell C. . . . .
2. Productivity due to extreme hardness. The HARDENED CROMOVAN TRIPLE DIE STEEL has extraordinary hardness whether quenched in air, oil or water. . . . .

The combination of these two useful characteristics in the one steel enables users of CROMOVAN TRIPLE DIE STEEL to save in two ways. First, in the manufacture of the die itself and, later, in the greatly increased production of which this steel is capable. . . .

# FIRTH-STERLING

# STEEL COMPANY

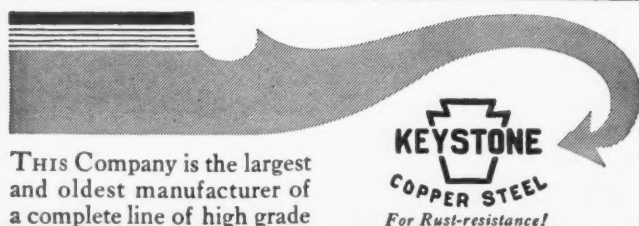
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FOR EVERY USE IN THE MACHINERY FIELD

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Four chilled  
iron discs  
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They are made in the following sizes

Swing	Greatest Distance Between Standards	Capacity in lbs
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40 "	30 "	2,000
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A simple and excellent device for balancing, straightening and truing.

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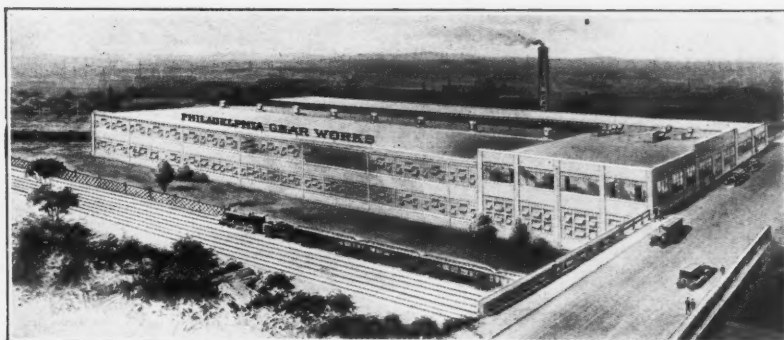
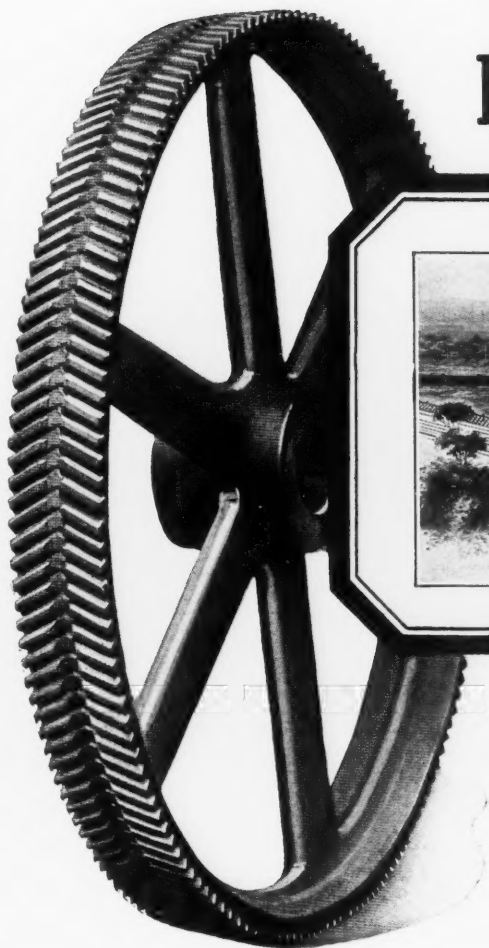
The busiest shops are using the Luma; they find that it saves money, time and labor. And it stands up in the heaviest service.

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Here's the biggest and most modern gear plant in America, at your service to turn out gears in a hurry, and all kinds of gears, at that. Nearly 50 years of experience combined with our new equipment, makes us the logical place for you to come with your gear troubles. We won't fail you.

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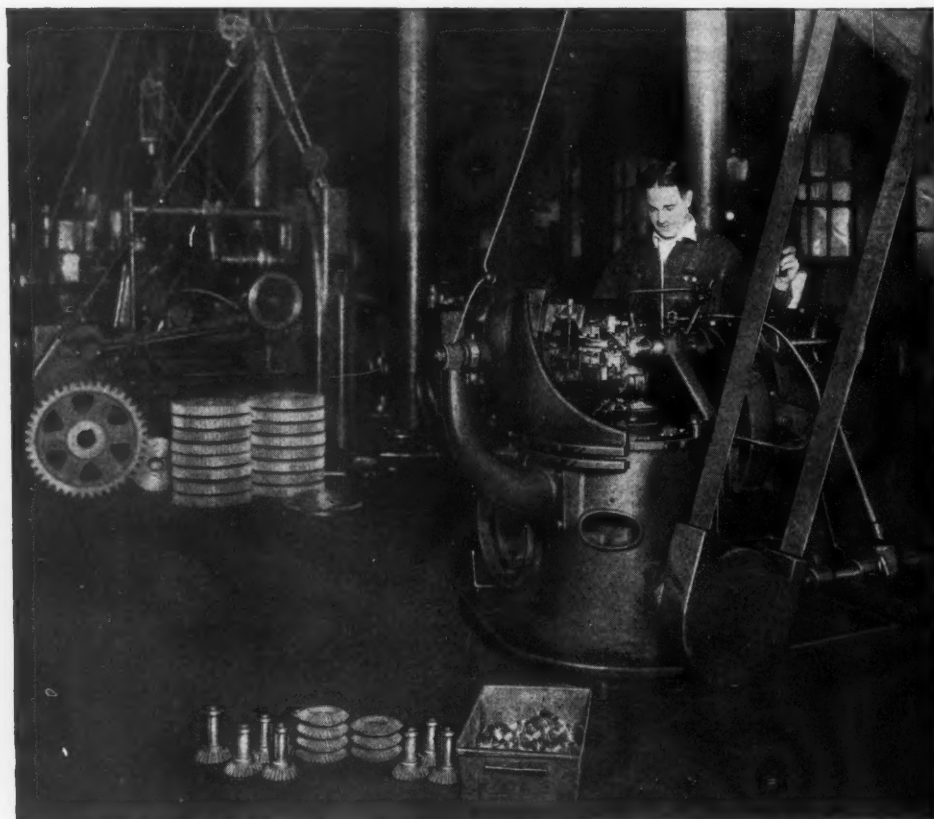
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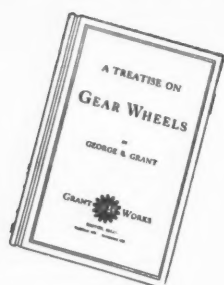


*Wanted:*  
**More gear  
users to  
satisfy —**

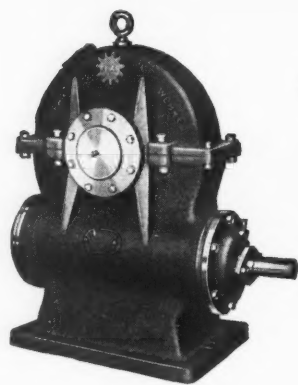
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Prices are right too,—modern machinery, skilled men, and fairness take care of that.

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In stock 5 standard sizes and 60 different ratios—1/20 to 25 h.p., giving a speed reduction from  $3\frac{3}{4}$  to 1 to 106 to 1.

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Signed \_\_\_\_\_

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Getting your gears to you when you want them is largely a matter of material resources. Getting them right is a matter of skill, experience and management.

Customers say we do both well.

Our equipment is second to none—every gear cutting machine is of the most modern type, brand new and individually motor driven.

Our shop is a daylight shop where men are glad to work. Our production system sees to it that promises are lived up to.

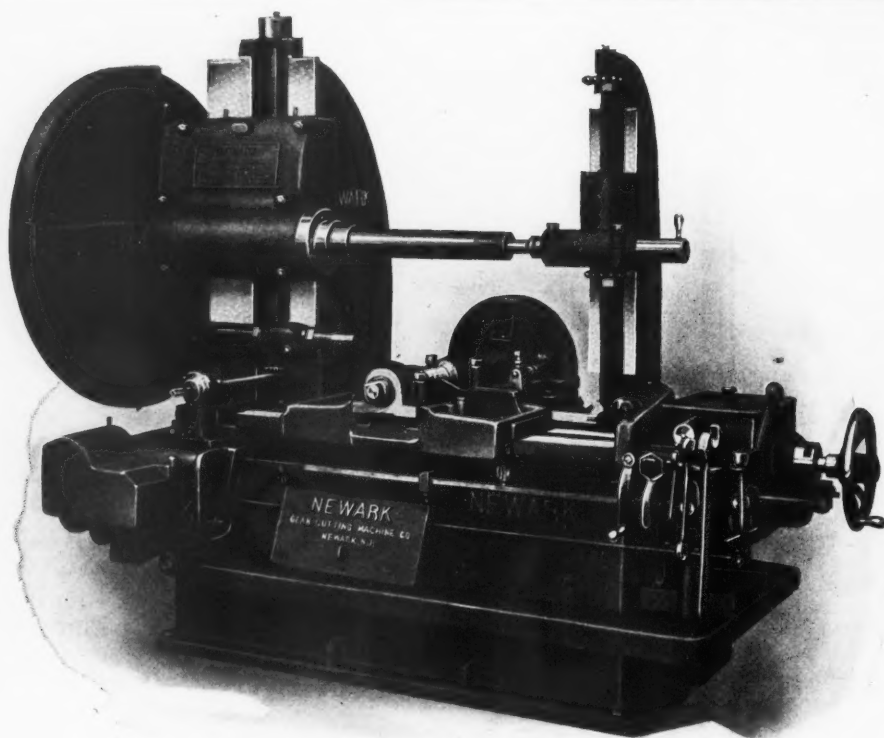
Our prices are noted for their fairness.

Let's see your specifications.

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SPUR GEARS WORM WHEELS BEVEL GEARS THREAD MILLING CAM CUTTING



## Newark Spur Gear Cutting Machines

### 4 Sizes

Newark Spur Gear Cutting machines made in four sizes:

No. 3—for spur gears 36" diameter by 10" face.

No. 55—for spur gears 48" diameter by 16" face.

No. 5—for spur gears 72" diameter by 16" face.

No. 7—for spur gears 100" diameter by 24" face.



The Newark No. 55 Automatic Spur Gear Cutters produce gears up to 48" diameter, 16" face rapidly, accurately, profitably. Operating simplicity, positive indexing mechanism with patented safety device and other valuable features. Send for details of Newark profitable gear production equipment.

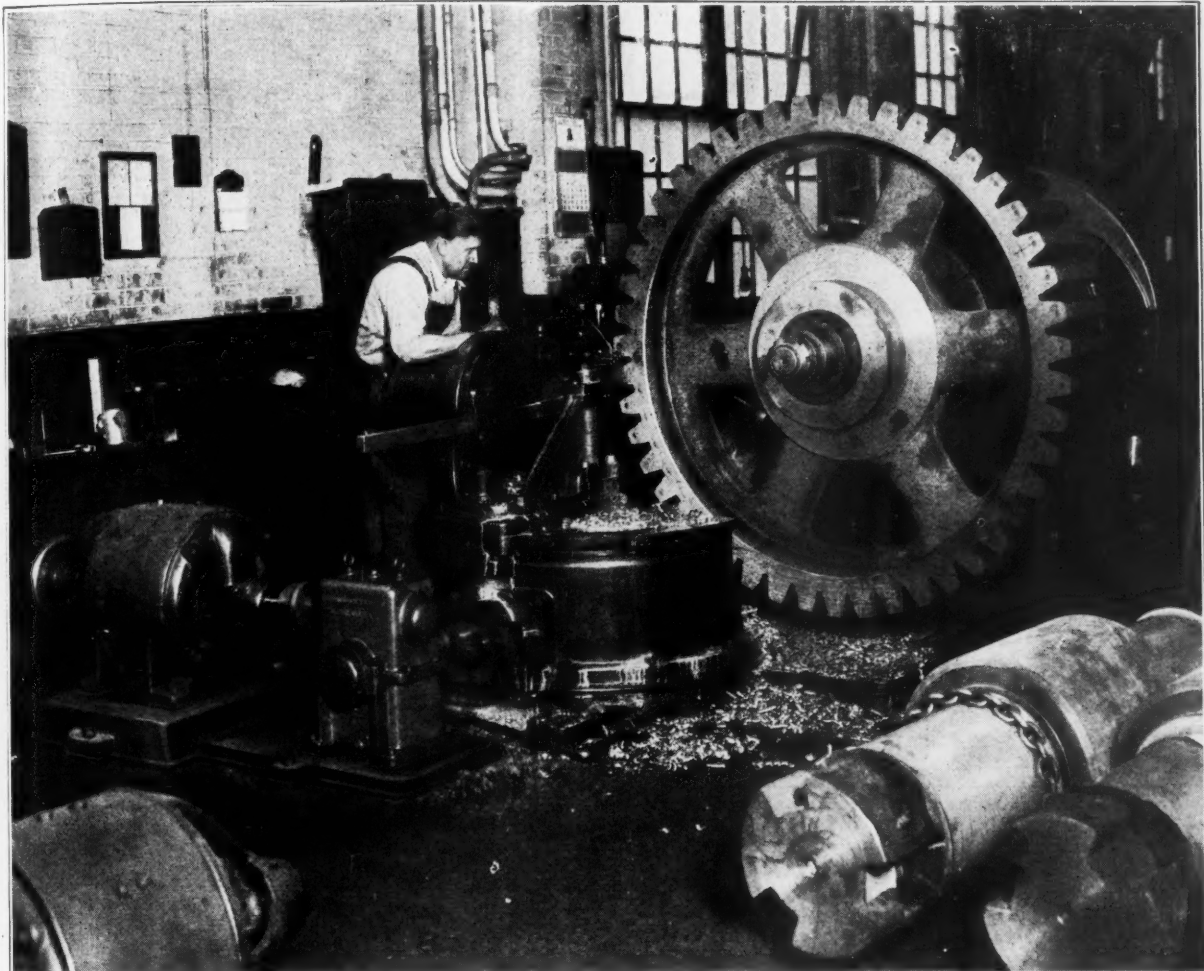
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Phone, Market 7725

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# DRIVE IT WITH GEARS



Following our own advice we "drive it with gears." A series 1200 Type WT Horsburgh & Scott Worm Gear Speed Reducer is the connecting link between this 10 H.P. variable speed motor and one of our large Gleason gear planers. Ratio 16 to 1. Since installing this reducer the time of cutting these 5" C.P. gears has been materially reduced. The smooth flow of power enables the machine to take a much heavier cut. The reducer has paid for itself many times. You too can cut your costs by installing Horsburgh & Scott Reducers. Send for dimension sheets and horsepower ratings.

**HORSBURGH & SCOTT**  
**GEARS AND SPEED REDUCERS**

# The Horsburgh & Scott Co.

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"Gear makers since '89"

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Gears for Every Industrial Purpose—Worm—Bevel—Herringbone—Spur—Spiral—  
Hardened Heat Treated Gears—Non-Metallic Gears and Pinions

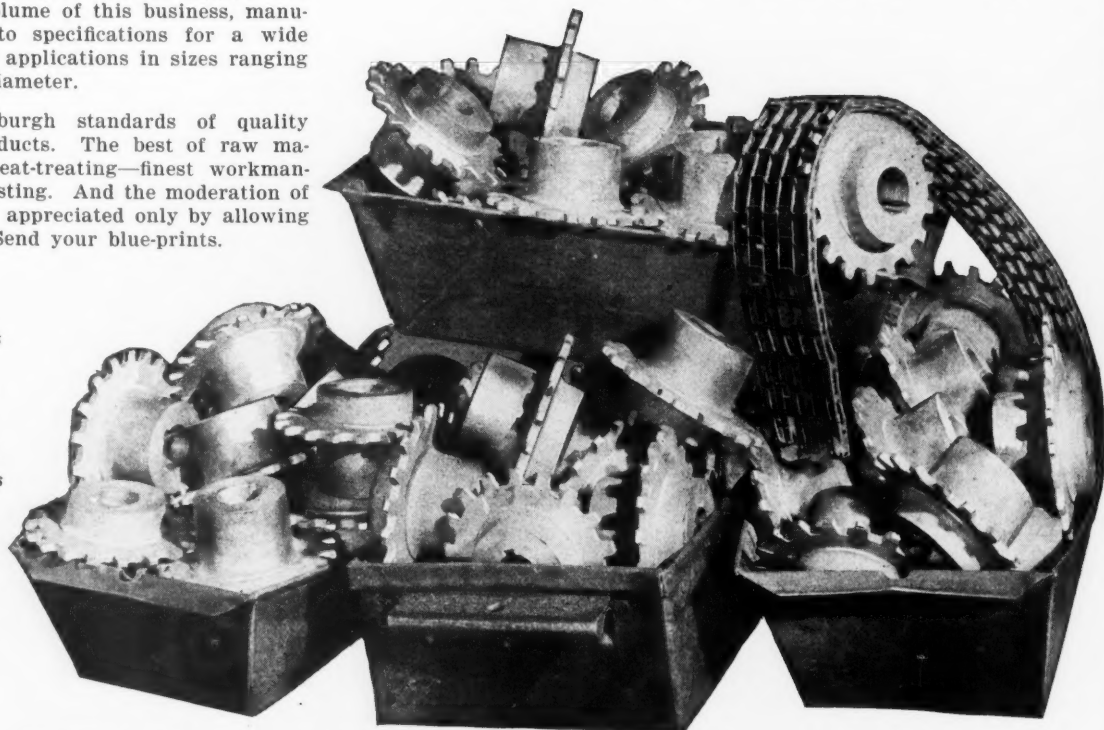


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The same reasons that have attracted the business of manufacturers with standard gear requirements, have convinced sprocket gear users that Pittsburgh is a good base of supply. We handle a large volume of this business, manufacturing gears to specifications for a wide range of sprocket applications in sizes ranging up to 6 feet in diameter.

The usual Pittsburgh standards of quality govern these products. The best of raw materials—careful heat-treating—finest workmanship—scientific testing. And the moderation of our prices can be appreciated only by allowing us to estimate. Send your blue-prints.

We are distributors for the General Electric Company and can give 48 hour service on orders for Fabroil and Textolite Gears



PITTSBURGH GEAR & MACHINE CO., 2700 Smallman St., Pittsburgh, Pa.

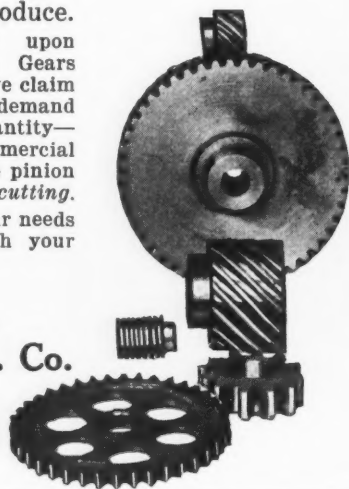
## MEISSELBACH-CATUCCI Small Gear Specialists

For more than thirty-five years we have been making gears—mainly small gears—and designing and manufacturing gear making machinery. We have been able to render a unique service to industry in supplying special gears to meet extraordinary demands—gears for cameras, moving picture machines, watches, typewriters, finishing reels, electric recording instruments, adding machines, and a score or more other devices. We control the special machinery which alone makes possible many of the gears we produce.

You can depend upon Meisselbach-Catucci Gears—they will do all we claim for them—all you demand of them. Any quantity—any style—any commercial gear material. Also pinion rods—bored after cutting. Let us quote on your needs—or help you with your gear problem.

**Meisselbach-Catucci Mfg. Co.**

54 Stanton Street  
Newark, N. J.



Twelfth Year

**SPUR  
BEVEL  
HELICAL**

# GEARS

Rawhide Bakelite and hardened steel pinions. Your blanks cut to specifications. Don't fail to get our prices. **QUALITY—SERVICE.**

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**High Production Models**

for Transmission Gears, Spline Shafts, etc.

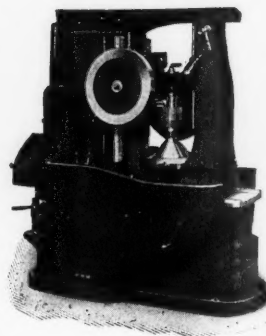
**Universal Models**  
for Spur, Worm and Spiral Gears

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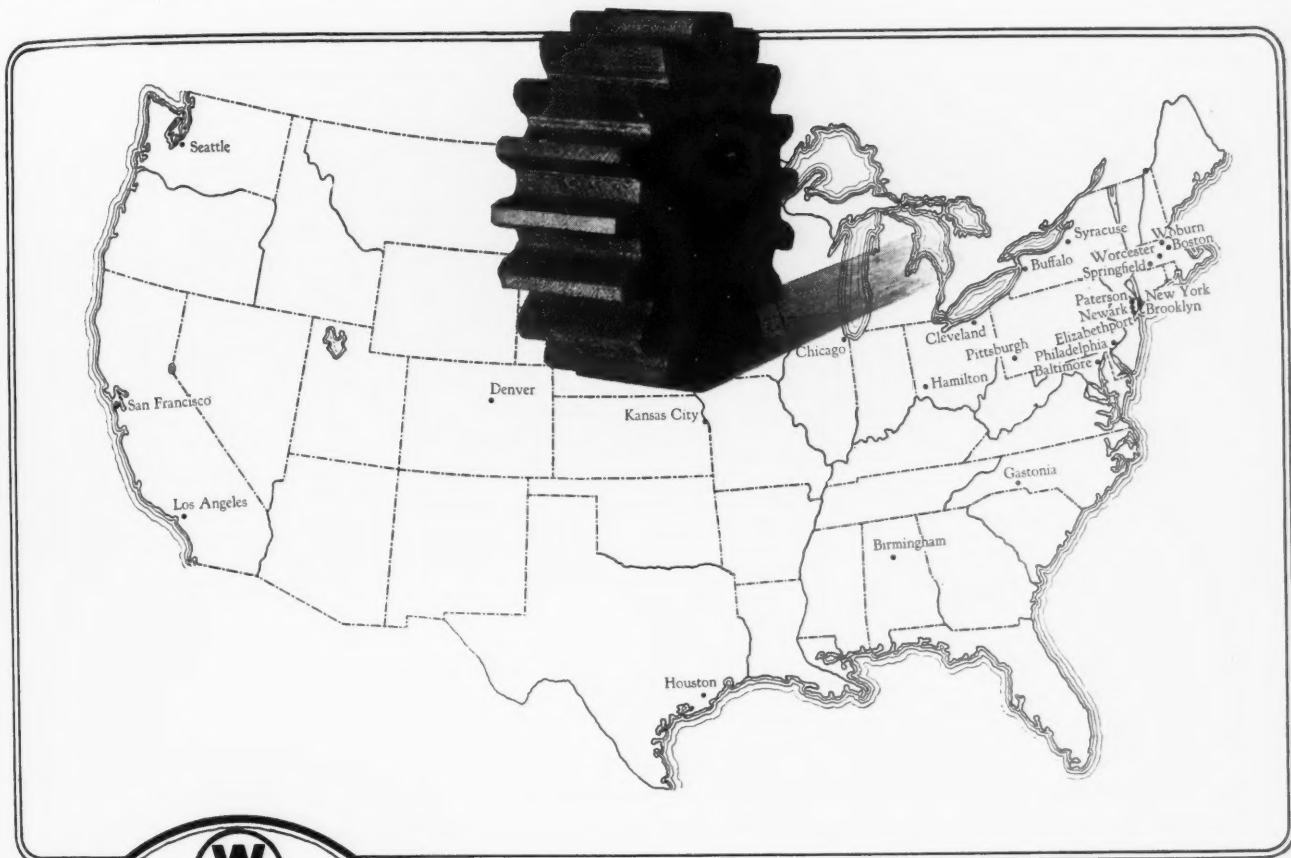
Representatives for United States and Canada

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21 Park Row, New York, N. Y.

Over 1500  
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in the U. S. A.



# WHERE MICARTA GEARS ARE CUT



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**Silent  
Gears & Pinions**

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Grant Gear Works	Van Dorn & Dutton Co.
Springfield	Hamilton
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Massachusetts Gear & Tool Co.	Rodney Davis
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	WASH. Seattle
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## FROM COAST TO COAST

MICARTA gears, distributed by the gear manufacturers listed here, are available from coast to coast. Each distributor is ready to give prompt and accurate gear cutting service. Accurately cut Micarta gears, supplemented by Micarta stamina, long life, and silence, assure economical gear performance.

Micarta gears are reliably serving every industry. Wherever dependable and lasting service is demanded, Micarta gears have proved their ability to withstand even the most severe service—in many cases with a longer life than the metallic gears which they replaced.

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Sales Offices in All Principal Cities of  
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# Westinghouse

X98706

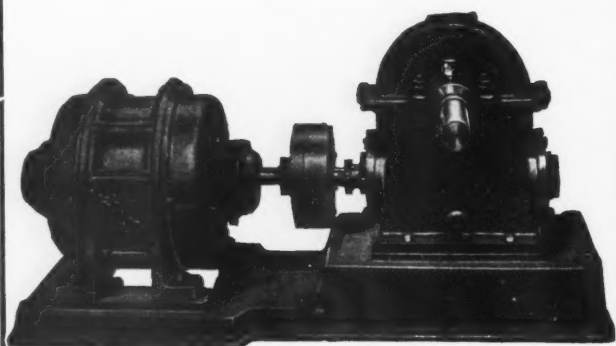
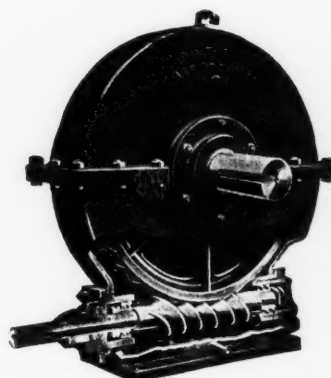
## Worm Gear and Spur Gear Speed Reducers

Efficient, Quiet and Compact

**GEARS OF EVERY DESCRIPTION**

**The A. & F. Brown Co.**

3rd Street and Port Avenue  
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Where loads are heavy and service severe, Hindley Worms and Worm Gears are insurance against breakdowns and replacements. Unique tooth shape gives a greater area in contact than ordinary worms and worm gears, hence greater strength and longer wear.

Hindley Worms and Worm Gears are stocked in sizes to meet most needs—specials to order. Spur, mitre and bevel gears also. Send for lists and prices.

**HINDLEY GEAR COMPANY**

1107 Frankford Ave., PHILADELPHIA, PA.

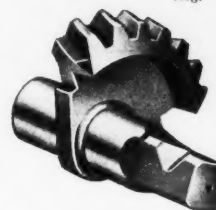
## MEISEL GEARS

*The Best at the Best Price*



Specifying Meisel Gears is the surest method of obtaining best quality at best prices. We cater to the type of machine manufacturers that expect this kind of service, and they remain with us because we stick to our policies. Try us. We firmly believe that we can make your gears to a higher standard of service, accuracy and dependability than you can procure elsewhere at similar cost.

*Estimates upon request.*



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## The ADAMS GEAR HOBBER AND THREAD MILLER

An Accurate, Versatile and Highly Productive Machine. Ask for Circular.

**THE ADAMS COMPANY** 1905 Market Street  
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## Bevel Gear Generators

All Types of Gears, also

**SKREW BEVEL GEARS**

Special facilities for straight and spiral Bevel Gears



**The Bilgram Machine Works**  
1231 Spring Garden Street, Philadelphia, Pa.



## CINCINNATI GEARS

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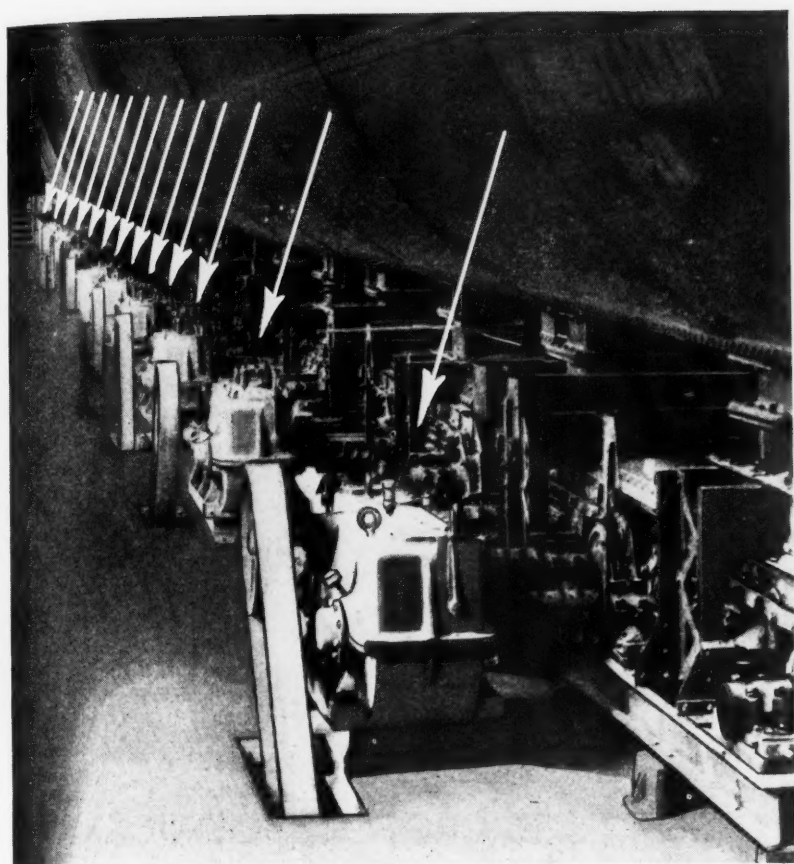
Cincinnati Gears are not only right in price, consistently accurate and of the very finest materials, but they are delivered *when promised*—and any machine maker who has contended with tardy gear shipments will appreciate this virtue.

File your drawings or blue-prints with us for *real* service.

**THE CINCINNATI GEAR COMPANY**

1825-1841 Reading Road, CINCINNATI, OHIO





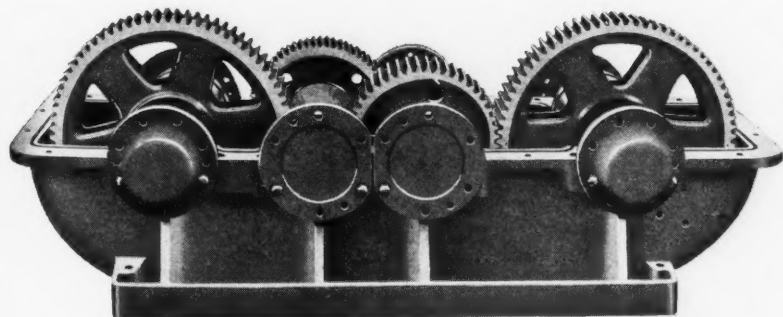
## More than 100 **Nuttall Reducers**

Used by One  
South American  
Copper Mining  
Company



*You can depend on Nuttall Speed Reducers to stand the severest service. All details are given in the Speed Reducer Bulletin. Your copy sent promptly on request.*

This impressive row of Nuttall Speed Reducers shows but a few of more than a hundred now installed by a South American copper mining company. The selection of Nuttall Reducers for service in this out-of-the-way spot, thousands of miles from renewals and service men, is a tribute to the sturdy dependability of these rugged machines. And the fact that this large number of reducers represents several repeat orders is further evidence of efficient, trouble-free service.



Exposed view of a Nuttall Speed Reducer Type S.A.-1. A double end type which permits driving two different but related devices. A clutch permits independent operation. Timken Bearings.

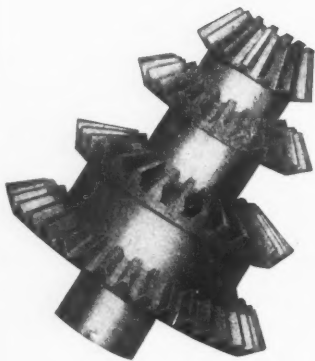
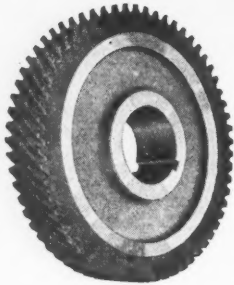
All Nuttall Products are sold through the Westinghouse Electric and Mfg. Co., district offices. Refer your inquiries to the nearest Westinghouse Office.



In Canada, Lyman Tube & Supply Co.,  
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# Westinghouse - Nuttall

# CHARLES E. CROFOOT GEAR CORP. GEARS



## Insure Your Product with Gears of Quality

Just as chains are as strong as their weakest links, so are machines as strong as their weakest gears. Gear trouble means loss of production time to the machine owner—and often loss of repeat sales to the machine builder. So insure your product—with GEARS BY CROFOOT.

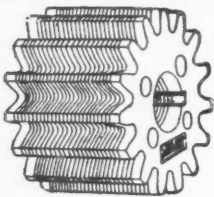
Sizes range from 1/8" to 36", accurately and expertly made to specifications. Our gear manufacturing experience covers a 20 year period, and our service includes a staff of engineers to assist you free of charge, on any problem. Right prices—prompt deliveries on any quantity.

*Send your blue prints.*

**CHARLES E. CROFOOT GEAR CORP.**

65 Central Street

South Easton, Mass.



## Gears, Mallets from Tough "Chicago Rawhide"

Here you have the toughest and most durable in Gears and Mallets—two "Chicago Rawhide" products.

"Chicago Rawhide" Gears and Gear Blanks are elastic, noiseless, long-lived, economical and strong.

Our "Chicago Rawhide" Mallets and Hide-Faced Hammers are non-conductors—they can't damage fine surfaces or soft metal work—just what you've been looking for. We also make Belting, Lace Leather, Cut Lacing, Hydraulic Packing.

*Write us for complete catalogue*



**The Chicago Rawhide Manufacturing Co.**

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Chicago, Ill., U. S. A.

Branch: 109 Broad St., New York

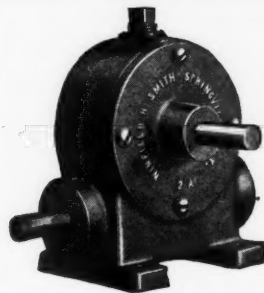
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## SPEED REDUCERS

In Stock  
for  
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For Motors  
up to 5 H.P.  
Capacity

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## FERGUSON GEAR CO.

CUT GEARS

CHAIN DRIVES

BEVEL SPUR SPIRAL WORM SPROCKETS

RAWHIDE BAKELITE AND HARDENED STEEL PINIONS

Member American Gear Manufacturers Association

**GASTONIA, NORTH CAROLINA**

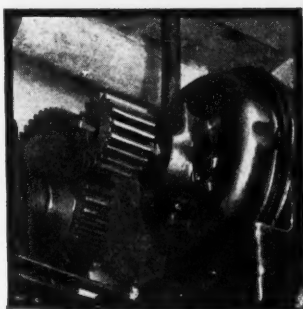
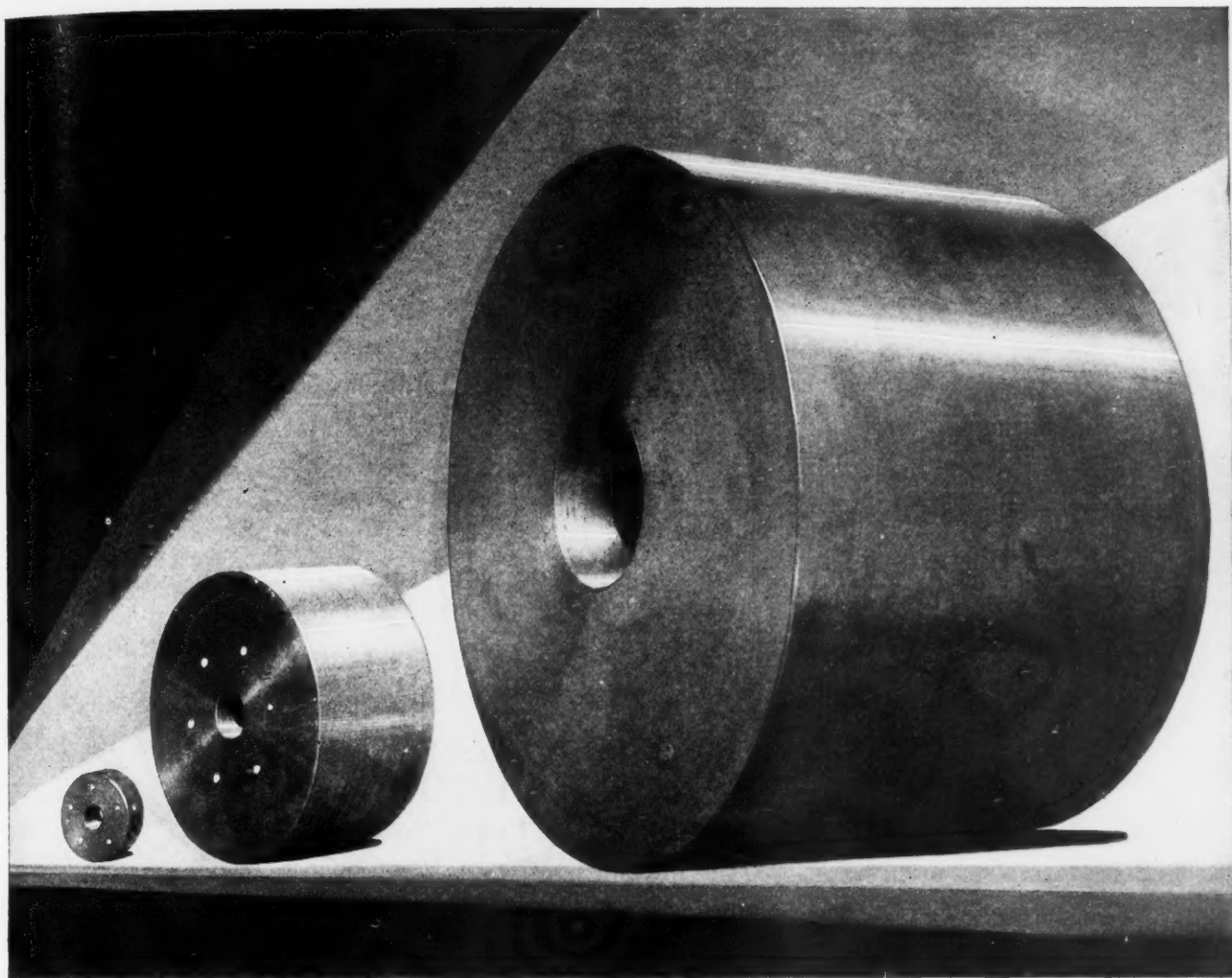
## EARLE

Cut Spur, Bevel, Herring-bone and Worm Gears

All sizes. Every description. Operating Machinery for Bridges, etc. "Lea Simplex" Cold Metal Saws.

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## GEARS



Double-D Steel Silent motor pinion in service. Patents applied for in U. S. and foreign countries.

**Chas. Bond Co.**

617 Arch St.  
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Distributors and Cutters in  
Philadelphia Territory.

## all silent - all steel all sizes


Cut the cost of your silent gears and pinions with the great strength and long life of Double-D Steel Silent gears. They provide much of the strength and life of solid steel, the bearing surface

of cast iron and non-metallic silence.

In addition, they provide their own dry-lubrication. Machine easily and accurately. Made in all sizes for strenuous service. Ask for prices and Folder 600.

**FLEXIBLE ENGINEERING CORPORATION**  
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# DOUBLE - D

All Metal  Silent Gears





Mass.



Gears

### *Highest Quality Gears for Every Purpose*

The particular gear user who jealously guards the quality of his product will find Massachusetts Gears unvaryingly high in quality and exactly in accordance with specifications every time.

Large stocks of standard gears enable us to ship promptly—and we are always ready to cut specials quickly to your order.


Spur, mitre, bevel and worm gears up to 3 ft. diameter, worms, racks, sprockets and pinions—in any commercial gear material.

*It will pay you to try Massachusetts Gears.*

#### **MASSACHUSETTS GEAR & TOOL COMPANY**


34 Nashua Street,  
Woburn, Mass.

**THE SIGN OF GOOD GEARS**



### **DIEFENDORF GEARS**

ALL METALS  
MICARTA, CELORON, FIBROC,  
RAWHIDE  
Spur, Straight Bevel, Spiral Bevel,  
Helical, Internal  
LET US QUOTE



**Diefendorf Gear Corporation**  
SYRACUSE, N. Y., U. S. A.

**G**EAR CUTTING. We not only have foundry and machine capacity for small and large gears but now have equipment to cut spur, spiral, herring-bone and worm gears up to 10' in diameter. We would be glad also to design your gears for you.

#### **THE ADAMSON MACHINE CO.**

Engineers, Machinists, Iron and Steel Founders  
AKRON, OHIO, U. S. A.



**Cut Gears, Racks, Worms,  
Worm Gears, Bakelite-  
Micarta, Special Machinery**

—Write—

**THE SIMONDS MFG. CO., Pittsburgh, Pa.**



**L**ARGE, cumbersome cast-iron spur gears; quietly meshing rawhide pinions; smoothly operating worm gears; accurately fitting mitre gears; these are a few of the various types of gears that we are furnishing to industries. There are other types, too, such as bevel gears and spiral gears. The materials used are steel, cast-iron, rawhide and bakelite.

Let us quote on your gear requirements, large or small. High speed service can be given when needed. High quality always. The most modern equipment throughout the plant insures service, protects quality, assures economy. Send your specifications to the home office, or to the branch office nearest you. Your inquiries will receive prompt attention.

## W. A. Jones Foundry & Machine Company

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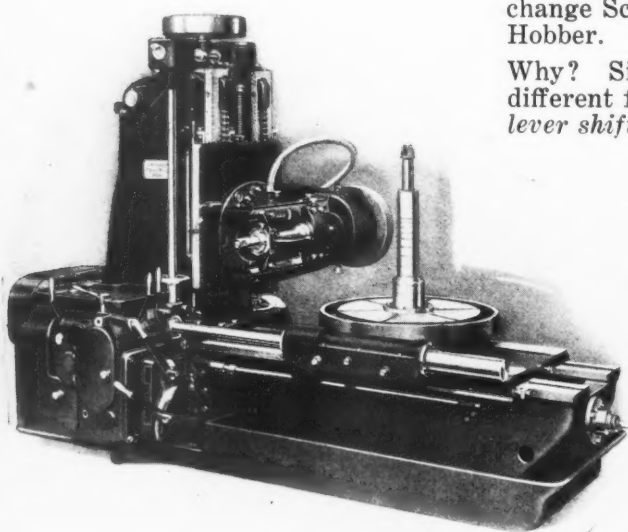
Detroit  
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# Jones Industrial Gears



# New Quick-Change SCHUCHARDT & SCHUTTE

Greater Profits From a  
Greater Gear Hobber



New standards of production—new conceptions of profit—new levels of economy have been established on gear hobbing in many plants since the introduction of the new quick-change Schuchardt and Schutte Gear Hobber.

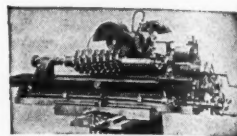
Why? Six cutter speeds and eight different feeds instantly available, by lever shift, at any stage of operation.

Rigid and powerful—torsion and chatter-free. 4 Flywheels to steady cutting action. Differential eliminates the figuring usually required in cutting spiral gears.

The Schuchardt and Schutte Gear Hobber is sturdily built of the finest materials for many years of trouble-free and profitable service.

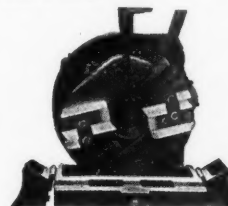
Write for NEW 20-page Catalog No. 926.

**GEO. SCHERR CO., 144 Liberty Street, New York City**



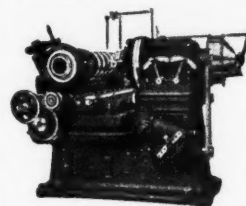
**S. & S. HOB and TOOL GRINDER**

Automatically indexed. Saves time wasted in constant stopping, starting and indexing by hand. Can be operated by unskilled help.



**ROTARY CUTTING-OFF MACHINE**

2 balanced cutting tools rotate around the work, which is stationary. Fastest production and smooth cut.

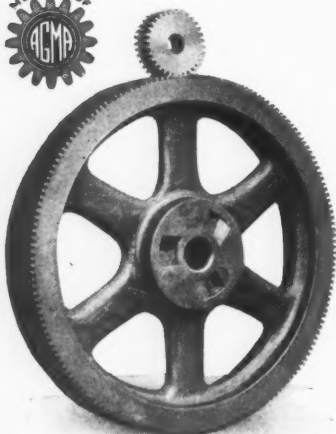


**S. & S. HEAVY DUTY WORM MILLER**

Rapid, economical production. Heavy cuts, smooth, vibrationless work. Symmetrical tooth flanks and highest accuracy of lead obtainable.

## STAHL GEARS

Built for Permanence

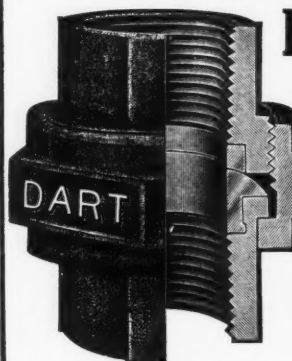


The surest way to insure a machine against gear troubles is to equip it with Stahl products. The high quality steel used—the care of workmanship and hair-splitting accuracy—guarantee these gears for the life of the tools they serve. Send us your blue-prints. Our estimate will reveal a gratifying moderation of price.

LIST OF PRODUCTS: Metal gears—spurs up to 72" dia., 1 1/4 D.P.; bevels up to 54" dia., 1 1/4 D.P.; spirals and herringbone gears up to 19" dia.; 3 D.P.; worm gears up to 18" dia., 3 D.P.; racks 8' long, 3 D.P. Rawhide gears any requirement up to 15" dia., 1 1/4 D.P. We also manufacture Formica Pinions.

**THE STAHL GEAR & MACHINE CO.**

1390 East 40th St., CLEVELAND, OHIO, U. S. A.



Samples and Prices  
on Request

## DART UNIONS

Two Bronze Seats

Dart Unions are made with two bronze seats which prevent corrosion at the joint. Jobs hooked up with Dart Unions stay tight where the usual malleable union would quickly rust out.

**E. M. Dart Mfg. Co.**

PROVIDENCE, R. I.

The Fairbanks Company

Sales Agents

Canadian Factory:

Dart Union Co., Ltd., Toronto

## CUT GEARS

## SPLINED SHAFTS

THE MACHINE PRODUCTS CO.  
1794 and 57 CLAIR AVE. CLEVELAND OHIO



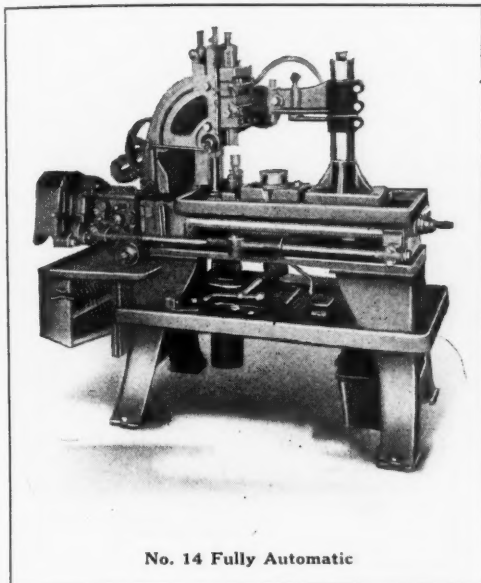
## Gears and Gear Cutting

We guarantee satisfaction

**RODNEY DAVIS**  
PHILADELPHIA, PA.



*For cutting odd lots of diversified gears—Reduce your costs  
by using*



No. 14 Fully Automatic

## Whiton Fully Automatic Gear Cutting Machines

They are easy to set up and are especially well adapted to meet the requirements of shops which have to produce a wide variety of gears. These machines can also be used to advantage on production work.

The machine shown will cut spur, bevel and worm gears up to 32" diameter.

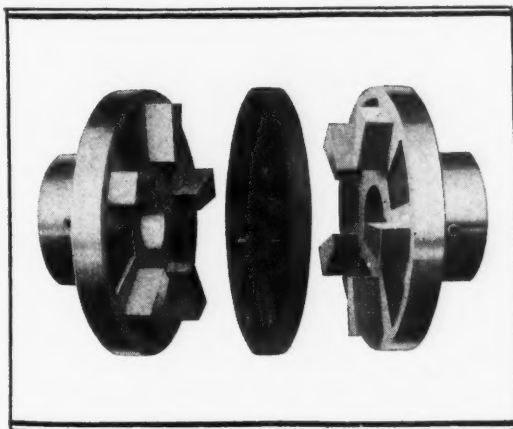
*Descriptive Literature on request*

**THE D. E. WHITON**  
NEW LONDON



**MACHINE COMPANY**  
CONNECTICUT

# WOOD'S *flexible couplings*



### Wood's Power Transmission Machinery

Shafting	Pulleys
Hangers	Pillow Blocks
Couplings	Belt Contactors
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Flexible Couplings	Ball Bearings



—form a perfect safeguard between the power and its goal by absorbing the destructive surges in a specially constructed leather disc, which provides flexibility in every direction.

Two cast iron flanges with lugs cast integral dovetail into holes in the leather disc forming a coupling that is as strong as solid steel, yet retaining the protective flexibility between direct connected motor and machine.

Always specify WOOD'S flexible couplings.

**T.B. Wood Sons Co.,**  
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NEW ENGLAND BRANCH:  
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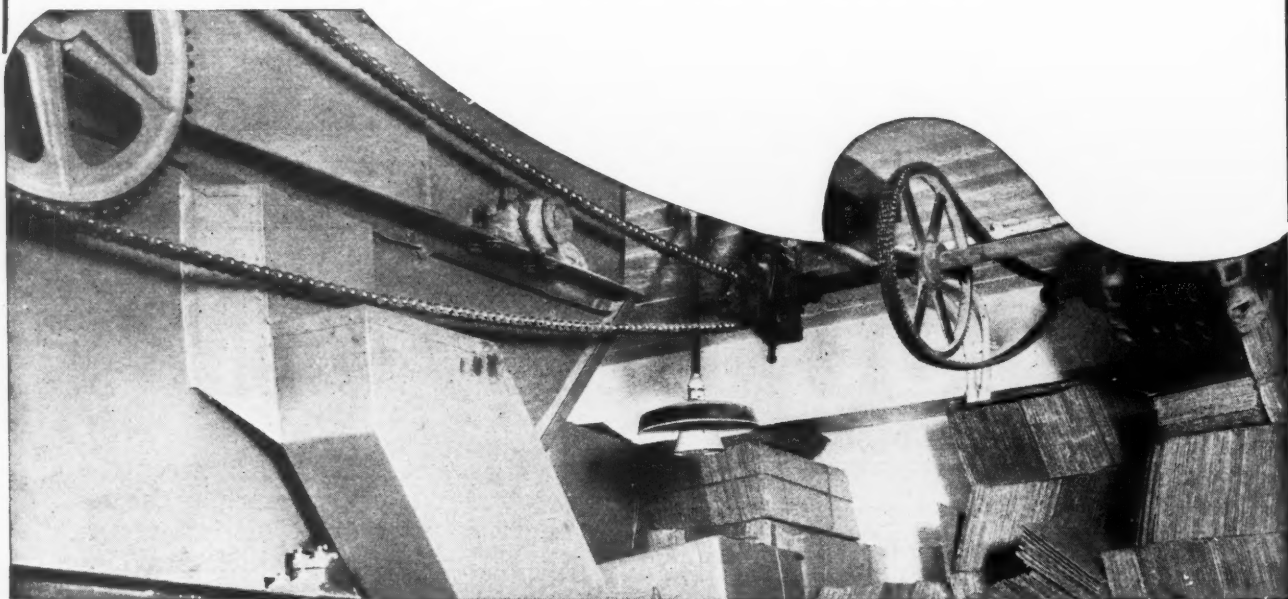
SOUTHERN BRANCH:  
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# Another example of fitting the drive to the job with "Whitney" Chains

The drives illustrated below—running at the Packing Plant of the California Almond Growers Association—show the adaptability of "WHITNEY" CHAINS to a typical double reduction transmission.

The motor-to-countershaft drive is of course a "WHITNEY" Silent Chain at short centers and high speed. The counter-to-line-shaft drive, at long centers and low speed, calls for "WHITNEY" Steel Roller Chain. Both drives are designed with a view to low initial cost, high efficiency and long life.

*Let our engineers fit the drive to YOUR JOB*



CALL OR WRITE OUR NEAREST OFFICE

**THE WHITNEY MFG. CO., Hartford, Conn.**

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549 W. Washington Blvd.

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2-240 General Motors Bldg.

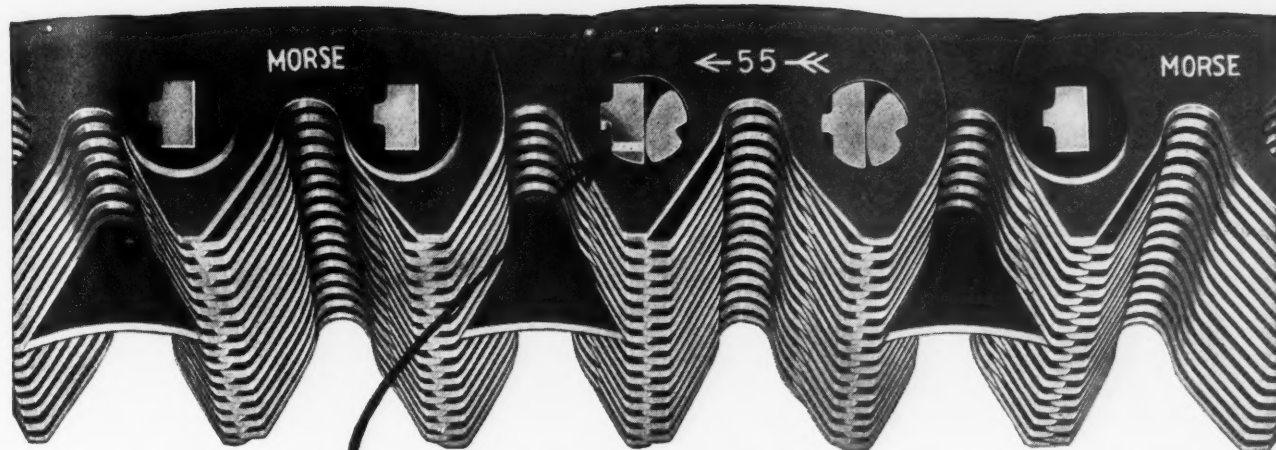
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**CHAINS AND SPROCKETS FOR POWER TRANSMISSION**



## The Original Morse Rocker Joint is improved

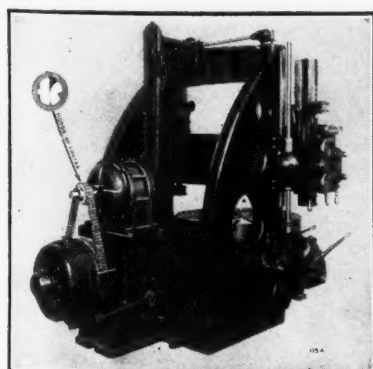
Morse Silent Chain Drives are noted for their dependability, long life and high efficiency. The superior Rocker Joint principle of silent chain operation has been largely responsible for the many years of dependable service that Morse Drives have given to industry.

Now, the design of the Morse Rocker Joint has been improved and even longer chain life is assured to Morse Chain users. The new type, known as No. 55, provides a better balanced joint, more rugged and sturdy, 8% heavier and with an increase of 50% in breaking strength. This means less wear and longer chain life.

Ask the nearest Morse Engineer about the new type No. 55 Morse Chain.

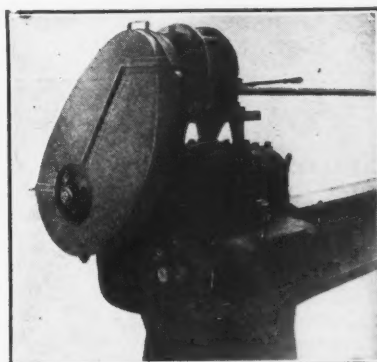
### MORSE CHAIN CO., ITHACA, N. Y.

*Morse Engineers are always available at:*



Gisholt Boring Mill.

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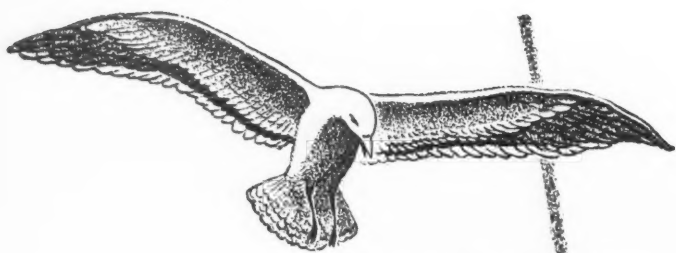


Lo Swing Lath, driven by 7½ H.P. Morse Silent Chain. Driver, 1160 r.p.m.; Driven, 500 r.p.m.; 24 inch centers.

# MORSE SILENT CHAIN DRIVES

2641





## SPEED and ACCURACY ... *Essentials*

Nowadays, manufacturers of equipment premise their production on the known demand for speed and accuracy. To reach this objective the subject of ball bearings must be carefully considered.

There are several important factors which indicate the desirability of using Torrington Ball Bearings. Accuracy. Stamina to withstand strains. And Torringtons are *long lived*. Construction is of a type to retain the lubricant.

Balance these features with the results users demand. The answer is Torrington . . . the product of a company which gave precision manufacture a new meaning.



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Either you are using the most suitable bearing or you are not.

This great organization of metallurgists and engineers can tell you. Such counsel costs you nothing and may save you much.

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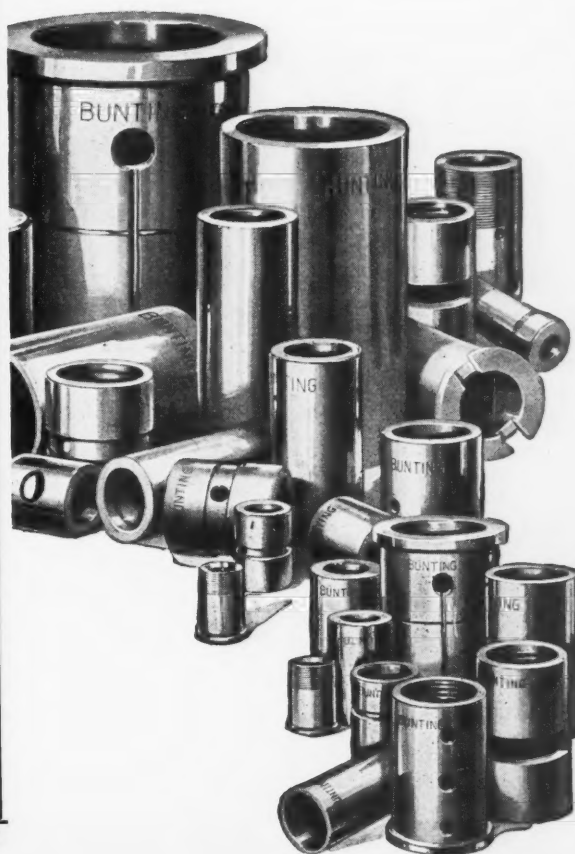
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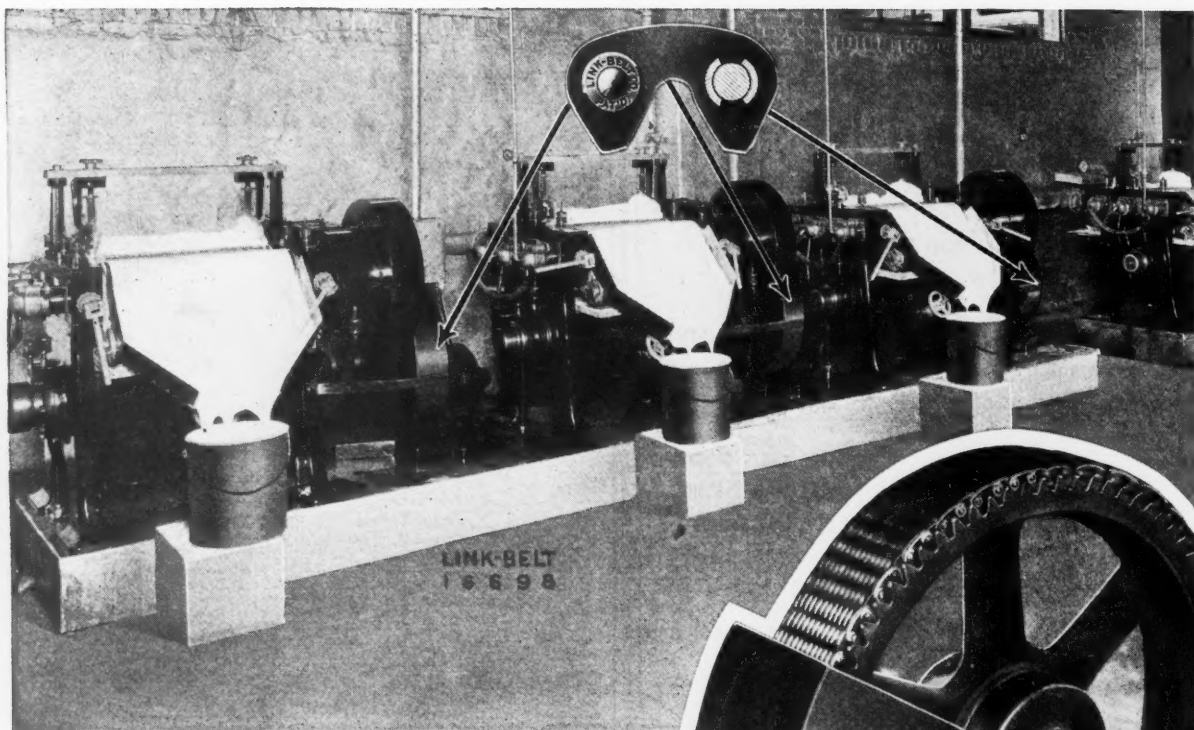


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# BUSHING BEARINGS

P A T E N T E D



## Used in Paint Factories, Too!

**T**HE Cook Paint & Varnish Co., North Kansas City, Mo., have derived such satisfactory service from Link-Belt Silent Chain Drives that they have *standardized* on this drive for their various factories.

The illustration above shows part of an installation of six J. H. Day Company Paint Mills, all equipped with Link-Belt Silent Chain Drives. Each mill uses a drive like that shown in the insert.

The wide ranges and uses of Link-Belt Silent Chain Drives are almost unbelievable. Put

your power transmission problem up to Link-Belt engineers.

Link-Belt Silent Chain Drives are made in sizes from  $\frac{1}{4}$  H. P. to 1000 H. P. and over. Drives  $\frac{1}{2}$  to 15 H. P. are carried in stock in many cities. Send for Data Book No. 125, and Stock List No. 725.

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Leading Manufacturers of Elevating, Conveying, and Power Transmission Chains and Machinery

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## SILENT CHAIN DRIVES



# STROM

Ball Bearings  
used in  
Edward yoke  
construction

*to promote  
easy closing and  
tight seating in  
heavy duty  
valves*



*The* Edward Valve & Manufactur-

ing Co. ball bearing yoke construction for the larger sizes of their valves [such as are used for high pressure service] includes Strom heavy duty angular contact bearings.

The Edward construction of this feature is unique. It employs double bearings having a greater thrust capacity than can be fitted into restricted space if straight thrust bearings were used. At the same time the bearings are designed to take radial load resulting from the use of geared operation, either motor or manually operated.

The superior features of Strom design and construction are especially valuable in applications of this kind. Only the large load capacity [both radial and thrust] of the Strom ball bearing would permit so compact a design as is indicated in the valve shown here.

The Strom engineering department is available for consultation on any matters of ball bearing application.

**Strom Bearings Co.**

4563 Palmer St., Chicago, Ill.

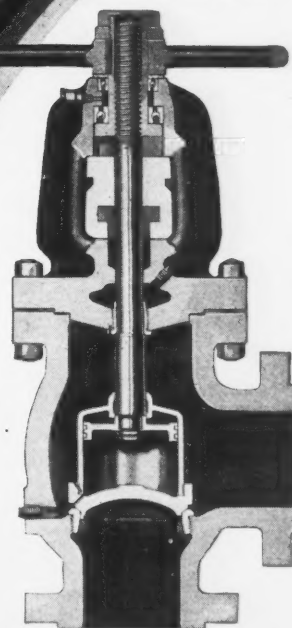
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Two Strom angular contact bearings provide thrust and radial load capacity in this yoke design.



**BALL BEARINGS**

—the only type which will  
keep shafts and gears  
in permanent alignment  
under radial adjustment

**Strom**  
**BALL BEARINGS**

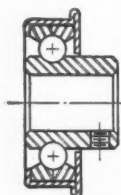
Manufacturers of a complete line of high-grade ball bearings—radial (single and double row), angular contact (single and double row), and thrust types

M8-Gray



# Here are the *Bearings* You have been looking for

**T**HERE is a "Commercial" bearing for every conceivable purpose or product. Cost is moderate. Service excellent. They are built with great precision. They have the famous three-point contact—a design which permits a larger number of balls. Easily withstand *combined* radial and thrust load with thrust in either direction. For service and economy, use "Commercials" in the product you make.



## A TYPICAL INSTALLATION

Illustration shows type A "Commercial" Annular Ball Bearing not ground. Made for shaft diameters  $\frac{1}{8}$ " to  $1\frac{1}{2}$ ". Outside diameters, exclusive of flange, from  $\frac{5}{8}$ " to  $3\frac{1}{16}$ ". Used in many different kinds of machines and mechanical devices.



Send for Illustrated Catalog, Discount Sheets and Samples

**THE SCHATZ MANUFACTURING COMPANY**  
Poughkeepsie, New York



# WHY

## TIMKENS SWEEP ON

THE WAY in which Timken Bearings have swept into dominance in so many types of industrial equipment has become the talk of all Industry. So radically and so rapidly have previous ideas of bearing performance been revolutionized by Timken Tapered Roller Bearings that the mechanical reasons which made this performance possible are sometimes lost sight of:

**RADIAL LOADS AND THRUST LOADS** Because of their tapered construction, Timken Bearings carry without compromise radial loads, thrust loads, or both loads in any combination, making possible more simple, compact, effective, wear-proof, and rigid mountings.

**GREATER LOAD AREA** Timkens are line contact bearings. Size for size, they have a greater capacity because the loads are distributed on the entire length of the rolls, cup and cone, instead of being concentrated on a very small area.

**POSITIVELY ALIGNED ROLLS** The design of the Timken Bearing provides for full contact along the entire length of the roll, cone and cup. The rolls are positively aligned to the axis of the cone and cup, thus allowing the bearing to function continuously at its full extra capacity.

**WEAR-PROOF** The longer life of Timken Bearings and their greater resistance to wear is made possible because the loads are distributed over the entire length of the rolls, cone and cup; because of the fact that radial, thrust and combination loads are provided for; because of the special analysis electric furnace Timken steel; because the parts are case hardened to

give them a glass-hard outer surface with a tough elastic inner core; and because each part is made to extremely accurate dimensions. Even after hundreds of millions of revolutions, wear in a Timken Bearing is so slight as to be practically imperceptible even when measured by delicate instruments.

**A PRECISION PRODUCT** So accurately and precisely made is the Timken Bearing that it has become the universal standard on machine tool spindles, where a few years ago such accuracy was thought beyond attainment.

**FRICTIONLESS** The Timken Bearing is practically 100% frictionless: The higher load capacity and greater wear resistance of tapered line contact are thus obtained at an insignificant power loss almost impossible to calculate.

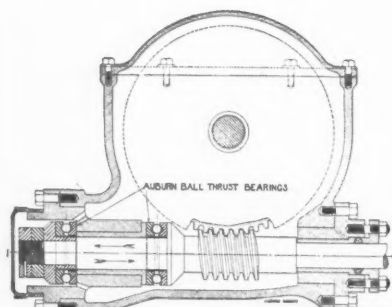
**TAKE-UP IN ASSEMBLY** The take-up feature in the Timken Bearing is a great advantage in assembly. Manufacturers find this to be of tremendous benefit, as it allows for minor machine irregularities, the locating of gears, etc. Last but not least, since slight wear is inevitable in any machine that revolves—(regardless of any statements to the contrary)—the Timken Bearing is designed for this take-up without affecting the proper operation of the bearing.

Revolutionizing operating and maintenance costs and stepping up production, they have brought a new day of manufacturing economies. Machine performance, never before thought possible, is now an accomplished fact. Timken dominance was inevitable. Timkens are sweeping on—wherever wheels and shafts turn.

**TIMKEN** *Tapered Roller* **BEARINGS**



## LONGER MACHINE LIFE *with* AUBURN THRUSTS



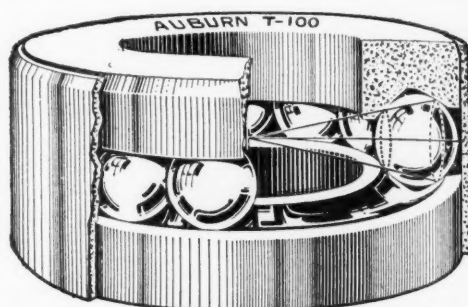
The use of Auburn Thrusts in your machinery reduces friction and wear and assures smoothness of operation, thereby lengthening the life of your machines. Adopt Auburn Thrusts and avoid shut downs for repairs. Write us about your bearing difficulties. Ask for data sheets.

Steel, Brass and Bronze Balls



**AUBURN BALL BEARING CO.,**

Established 1893



**33 Elizabeth St., Rochester, N.Y.**

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WHEREVER you need a bearing to take a straight thrust, B. C. A. Thrust Ball Bearings fill the bill with dependability and economy.

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STEEL BALLS  
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**Heavy Duty Ball Thrust Bearings**

STANDARD DIMENSIONS  
or to ORDER, up to 12" Shaft Dia.  
ONE OR ONE THOUSAND

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for  
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 $\frac{1}{2}$  H.P. to 10 H.P.  
Reduction Ratio  
1-1 to 7-1 in Stock

Whitney High Speed  
Silent Chains on hand.  
Driving Sprockets of  
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Set-screws to suit your require-  
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**CULLMAN WHEEL CO., 1339 Altgeld St., Chicago, Ill.**

**MOORE & WHITE**

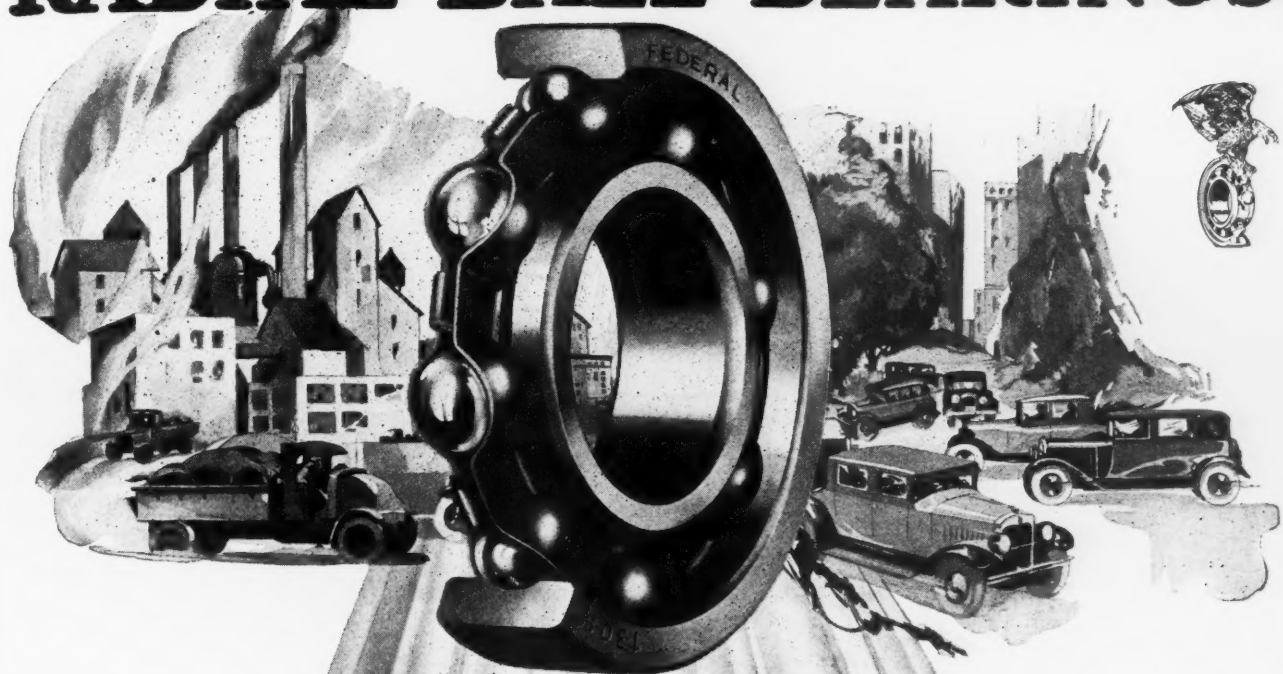
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The standard for  
43 years  
Over 300,000 in  
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Catalog "M" Sent Free  
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# FEDERAL

## RADIAL BALL BEARINGS



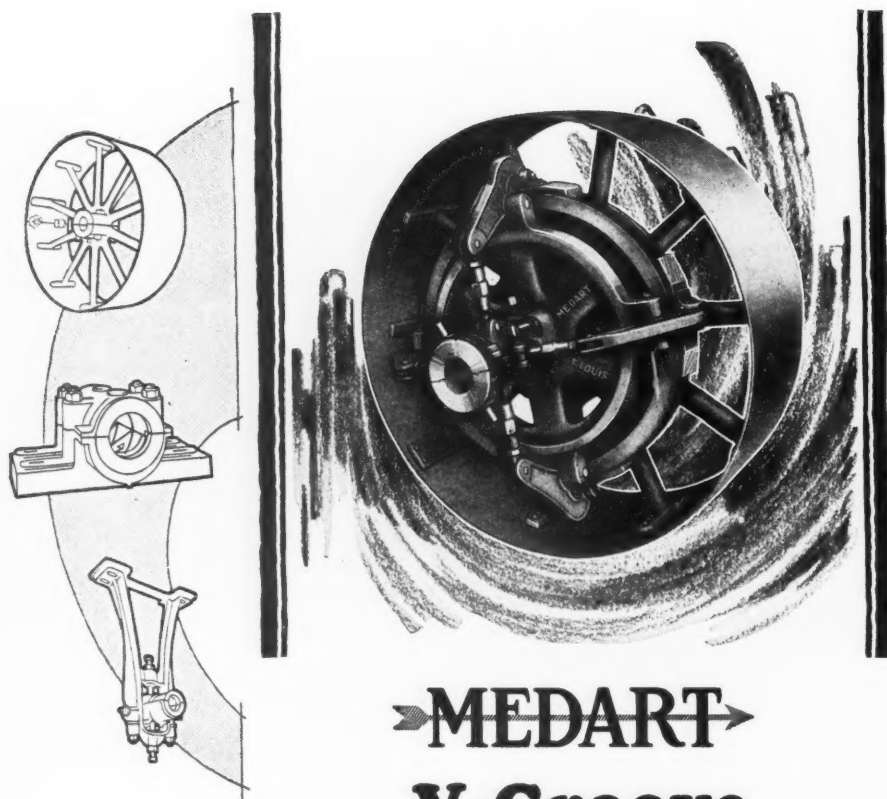
**C**ONTINUOUS calibrating of all measuring instruments and devices used in the manufacture of FEDERAL Radial Ball Bearings, assures accuracy so essential to the efficient performance of a ball bearing. Precision is observed throughout every process—from beginning to end. FEDERAL standards demand a *higher* degree of accuracy than is usually the case with the average bearing. Those who demand absolute accuracy and unfailing precision, buy and use **FEDERAL RADIAL BALL BEARINGS.**

*We shall be pleased to forward samples, quotations and complete information to those interested.*

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**THE FEDERAL BEARINGS CO., Inc.** Poughkeepsie, New York  
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# ACCURACY



## → **MEDART** → **V-Groove** **Friction Clutches**

*Large starting capacity, great mechanical strength and wide adaptability make Medart V-Groove Friction Clutches ideal for general power transmission work.*

They can be used either as a clutch cut-off coupling or as a clutch integral with a pulley, gear, sheave or sprocket . . . so that either a department, a line, a countershaft or a single machine may be placed under separate control.

Built either solid or split . . . their rugged simplicity of construction, ease of adjustment and positive action insure an excess of mechanical strength to care for sudden heavy loads. The special machined V-Groove gives unusual starting capacity . . . free from shock or jar.

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For "Everything in Line Shafting Equipment" get Catalog 43 and Discount Sheet; also Bulletin on Medart Timken-equipped Line of Industrial Appliances.

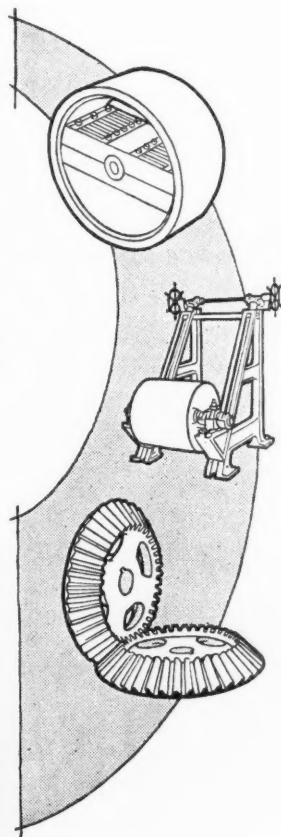
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*(Formerly Medart Patent Pulley Co.)*

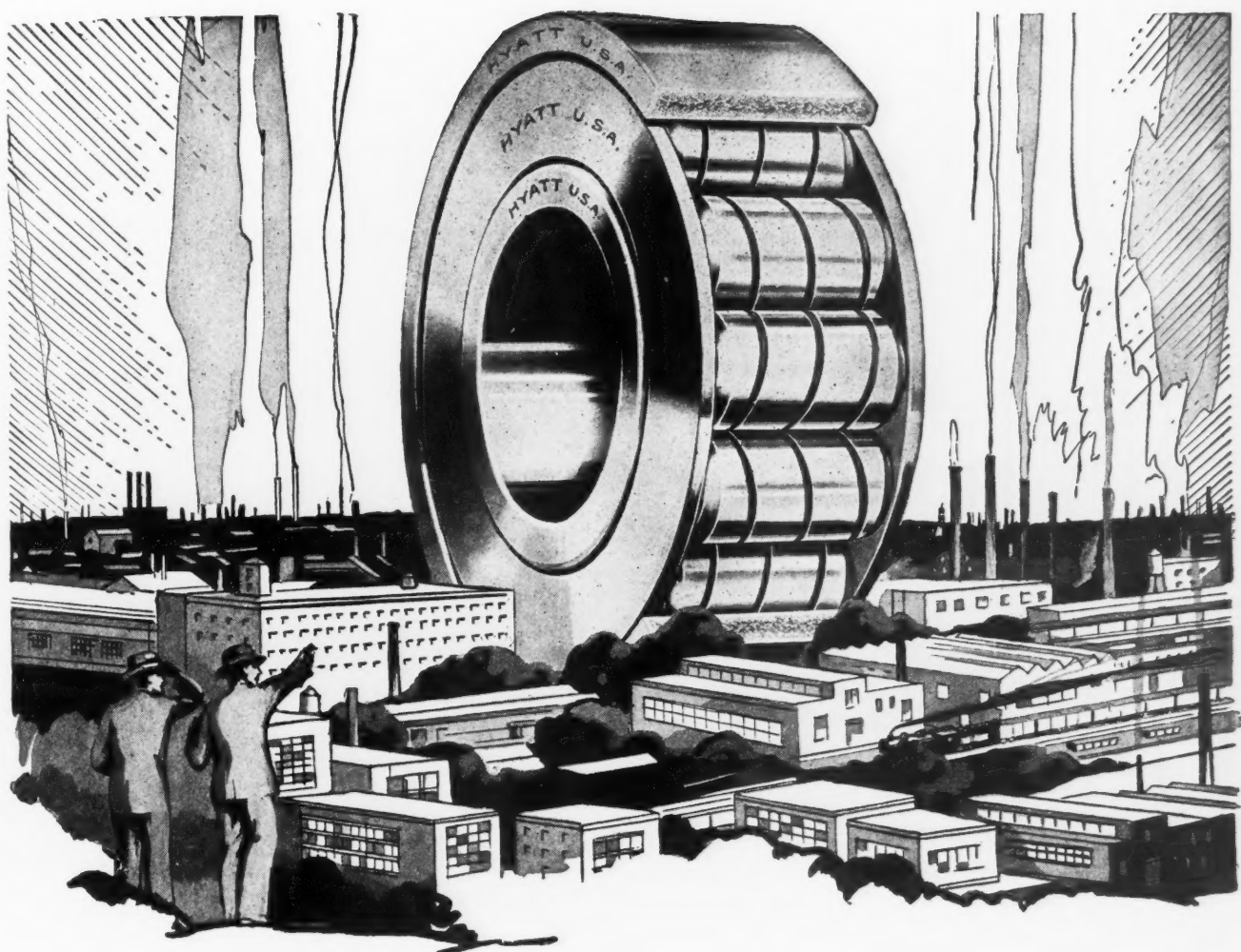
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**I**N their matchless performance, sturdy Hyatts have supplied the final endorsement of anti-friction bearings.

Throughout all industry . . . in automotive, railroad, industrial and farm equipment . . . their magical endurance and economy has won them overwhelming preference.

With Hyatts, power waste, friction, wear and lubrication needs are mini-

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These are good and sufficient reasons for Hyatt supremacy.

But often more important to industrial progress is Hyatt's aptness for solving the most difficult of engineering problems.

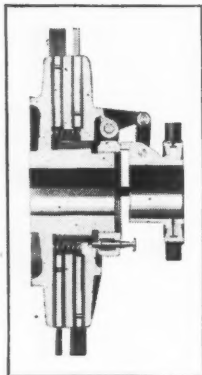
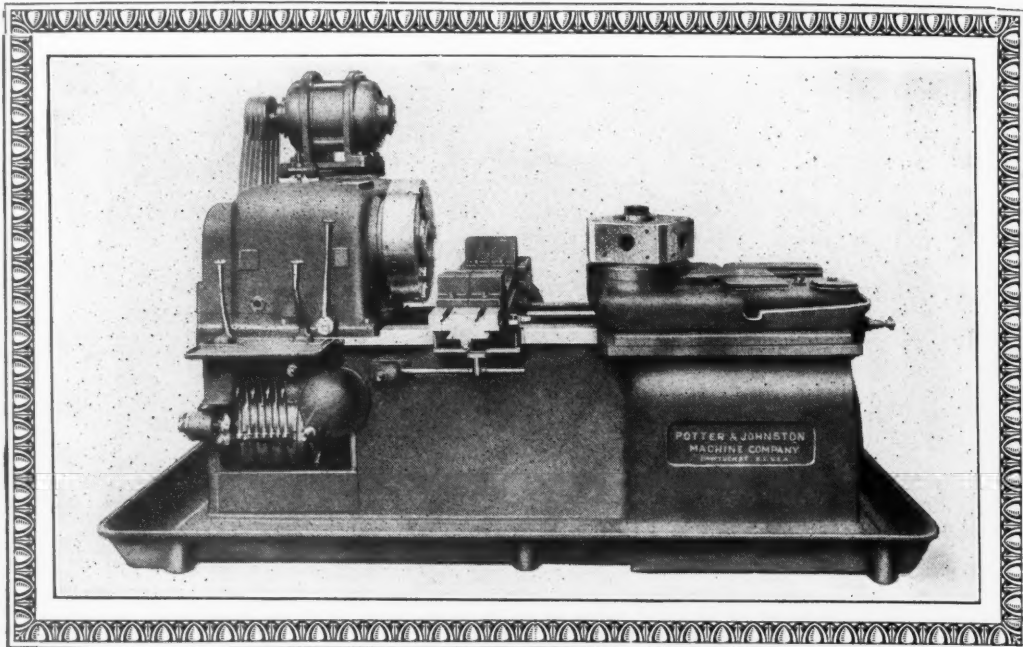
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HYATT ROLLER BEARING COMPANY  
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# HYATT

## ROLLER BEARINGS

PRODUCT OF GENERAL MOTORS



# TWIN DISC CLUTCHES

## Practical Advantages

**B**ECAUSE it assures smooth starting and steady operation during the life of the machine; because it lends itself readily to good machine design and because it can be easily maintained in perfect adjustment without loss of valuable time, Potter & Johnston have selected the Twin Disc Clutch as the drive control for their automatic machine tools.

An impressive list of machine tool manufacturers are now using the Twin Disc clutch as standard equipment. Its demonstrated superiority can be obtained at an attractive price. Write.

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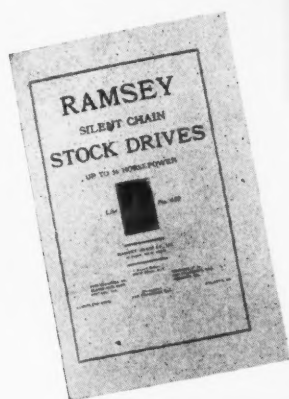
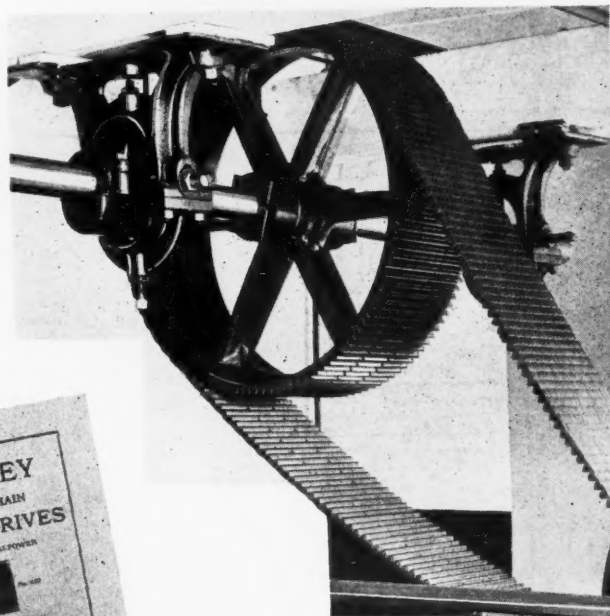
Boston (25), Mass.—Standard Auto Gear Co., 531 Columbia Road.  
Buffalo, N. Y.—Edward W. Rode, 45 A. St.  
Cleveland—Ohio Engine Parts and Service Co., 1053 E. 61st St.  
Chicago—Motive Parts Co. of America, Inc., 2419 Indiana Ave.  
Des Moines—Motive Parts Co. of America, Inc., 1204 W. Grand Ave.  
Detroit—Whitney Brothers, 6464 Epworth Blvd.  
Los Angeles—Coast Machinery Corporation, 406 E. Third St.  
New York City—John Reiner & Company, Inc., 309 Church St.  
Philadelphia, Pa.—Maerky Machine Works, 240 Cherry St.  
Pittsburgh, Pa.—Motive Parts Co. of Pa., 6314 Penn. Ave.  
Raleigh N. C.—Motor & Equipment Co., 215 E. Davie St.  
San Francisco—F. Somers Peterson Co., 57 California St.  
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**TWIN DISC CLUTCH COMPANY**  
RACINE, WISCONSIN

# Ramsey Silent Chain Drives

On Centers Too Close for a Belt—  
Too Far For Gears

Improving  
Power  
Transmission



100 H.P. Ramsey Silent Chain Drive operating a Generator. Chain 1 x 12 inches.

The roller joint action of Ramsey Silent Chain takes the trouble out of the difficult drive. For instance—it delivers the power needed to drive this generator without variation and *without loss*—the 100 H.P. at the shaft is 100 H.P. at the generator *and always the same*. And the elimination of power waste due to slippage or other transmission faults is a particularly important factor in a drive of this kind.

The secret is in the frictionless roller bearing joints (a Ramsey patent feature) that insures a smooth, vibrationless drive and highly profitable service.

"In stock" to 36 H.P.—Ramsey Silent Chains are ready for service on a wide range of work. Send for the new stock list.

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SILENT CHAIN DRIVES

RAMSEY CHAIN CO., Inc.

1039 BROADWAY

ALBANY, N. Y.

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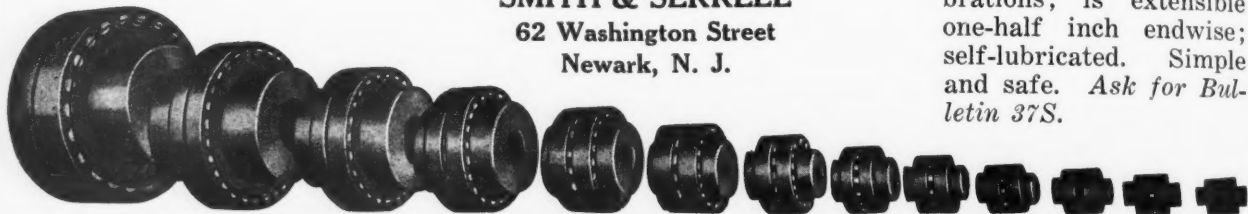


All Metal, Durable  
Any Power, Speed  
or Service.

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FLEXIBLE COUPLINGS

For Motor, Turbine, Engine Drives

SMITH & SERRELL  
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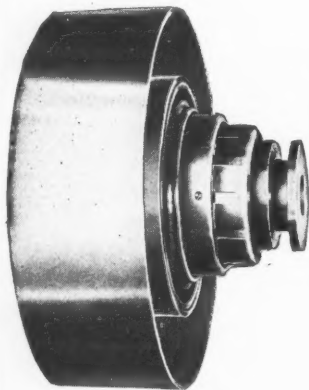
### The Improved Bush Pin Type

handles all accidental shaft misalignments; cushions shocks and vibrations; is extensible one-half inch endwise; self-lubricated. Simple and safe. Ask for Bulletin 37S.

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*For All Drives*

Built right, designed right—the Edgemont Line of friction clutches efficiently meets every clutch need. Simple construction, few parts, reduce wear to the minimum and simplify adjustments; burn proof brake linings require no oiling, and are easily renewable.



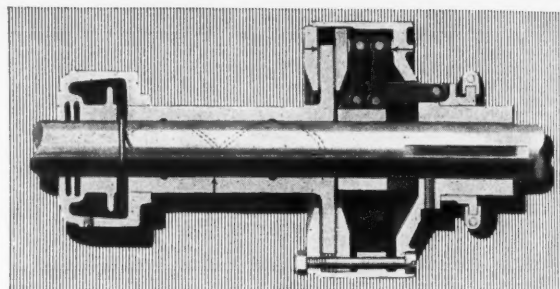
Type E

Edgemont Clutches,  
Cut-Off Couplings,  
Clutch Pulleys,  
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Clutches and Special  
Clutches for all  
purposes.

Send for Catalog H



The Edgemont Machine Co.  
2700 National Ave., DAYTON, OHIO, U.S.A.



## Stop the Leaks

*When—*

- a man is injured and your entire force demoralized—
- you have to stop an entire department to take down one machine—
- a production unit goes out through failure of the driving means—

**You Lose Money!**



**MULE-PULL CLUTCHES**

Stop these leaks—They permit instant stopping. Each machine is independent of others. Mule Pull Clutches are *dependable*.

*An interesting circular describes Mule Pull Clutches in detail. Let us mail you a copy.*

Brown Engineering Co., 133 No. 3rd St., Reading, Pa.

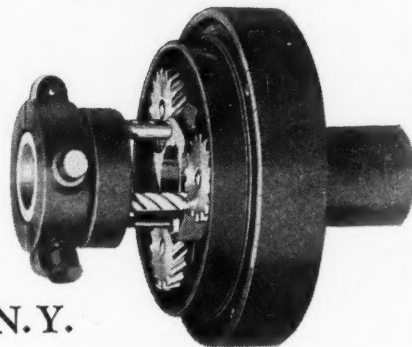
**Brown**  
READING, PENNA.

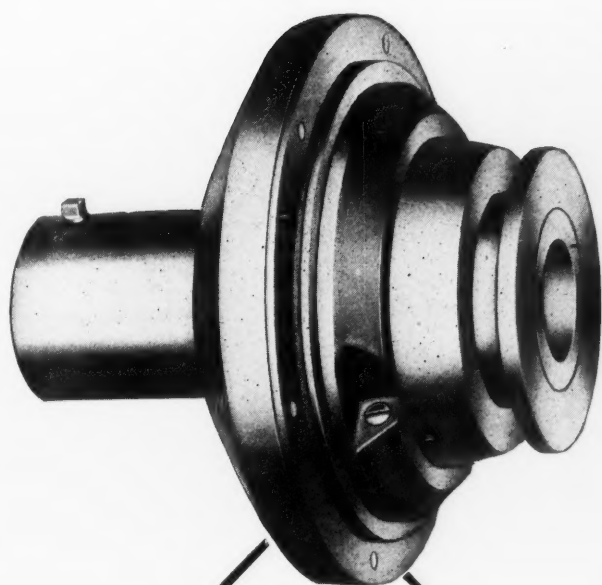
## A Superior Clutch—Sensibly Priced

A clutch, to be efficient in service, must be simple in design. Hilliards are unusually dependable because they are made with fewer parts. There are no toggle joints or levers to produce pressure on the friction surfaces—thus less lubrication is required and few readjustments are necessary.

Why not cash in on our 20 years of specialized experience? Our engineers will gladly consult with you, without obligation. Write us.

THE HILLIARD CORPORATION, Elmira, N. Y.





## The Conway Disc Clutch

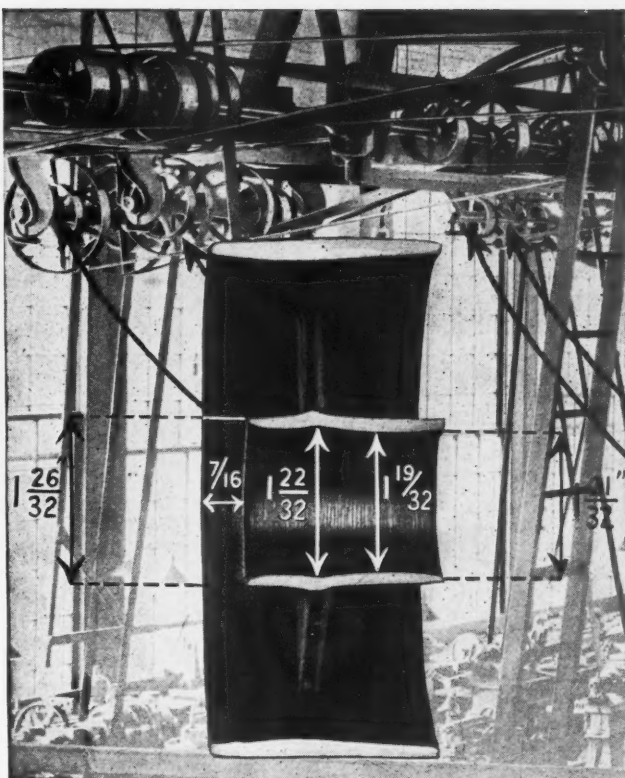
is the last word in  
Friction Clutches

Entirely enclosed,  
Inherently balanced,  
With under-slung levers,  
Large lever ratio,  
Accessible, accurate adjustment,  
Easy engagement—Quick release,  
Drag free idling,  
Centripetal action,  
Helped instead of hindered by centrifugal  
force,  
Steel Discs,  
Chrome-nickel forged levers,  
Full length bearing for loose member.

*It's the first progressive departure in the  
design of Disc Clutches in many years.  
Investigate Conway Clutches.*

**The Conway Clutch Co.**  
1962 W. SIXTH STREET  
CINCINNATI, OHIO

**There's a Kick in the Click  
of an Efficient Drive**



## Friction Won in Spite of Frequent Oilings

This loose pulley did its best against heavy odds, but finally lost out in its fight with friction. Intermittent oiling and less attention—the usual treatment of countershafts on quantity production machines.

Here is a pulley originally 15/16 inch, worn from 1-19/32 inches (1 5/8") to 1-26/32 inches (1-11/16") and the shaft on which this pulley ran cut almost in half.

### Wear—Wear —Lost Production—

An Arguto Bearing would have eliminated this. They show records of 20 years of service without oiling.

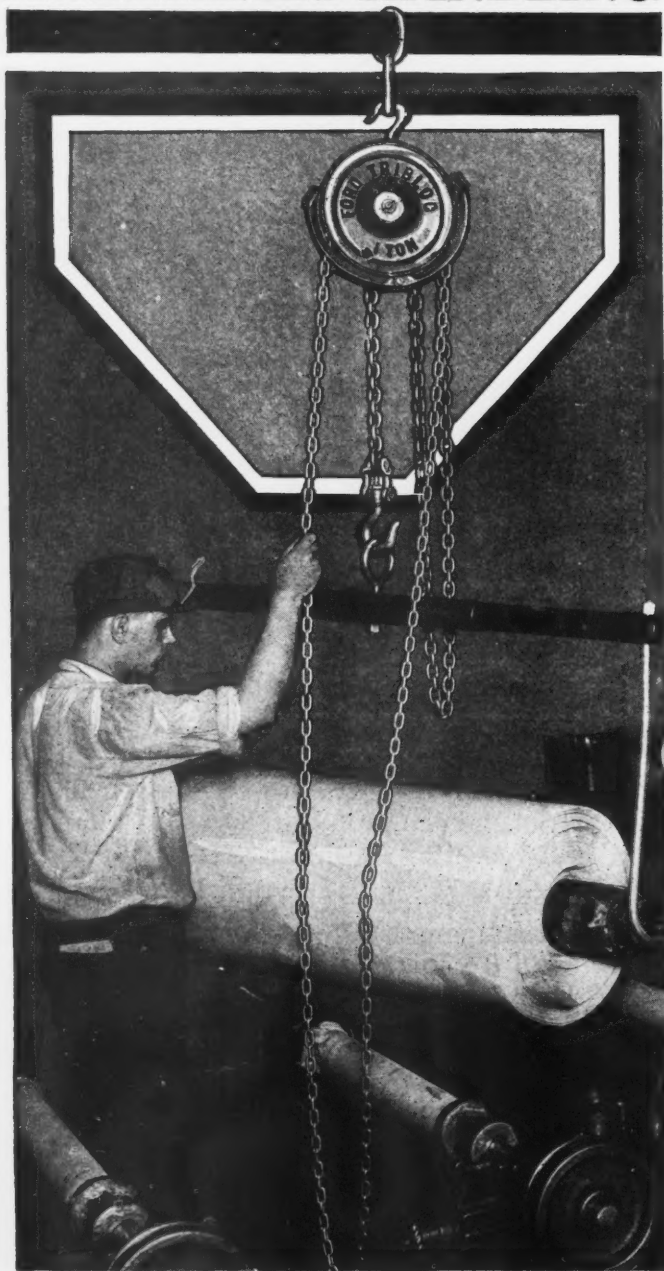


**ARGUTO OILLESS BEARING CO.**  
145 W. Berkley St., Wayne Junction, Philadelphia



**OILLESS BEARINGS**

# FORD TRIBLOCS FOR MATERIALS HANDLING



**F**ORD TRIBLOCS are a favorite in paper mills because they handle heavy loads quickly and easily and stand up in the heavy service of handling paper rolls and machinery.

**FORD CHAIN BLOCK CO., PHILA., PA.**

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The two main factors for giving Satisfaction are Economy and Service. Right from the start, Harrington Electric Hoists are economical. They are standardized for that reason; two capacities, 2 methods of control, 2 speeds but only one size housing. Also, all parts are standardized and are readily interchangeable. There are at least 38 reasons (all fully explained in a folder we should like to send you) why the Harrington Hoist is a SERVICE Hoist. The list of SATISFIED Harrington users is steadily growing, so don't fail to learn just what you can gain by using a Harrington Electric Hoist.

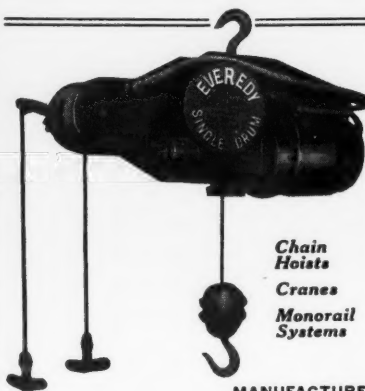
**THE HARRINGTON COMPANY  
PHILADELPHIA**



## Some Style of HANNA HOISTS

Can also be Used for  
Lowering and Raising  
Doors or Gates

**Hanna Engineering Works**  
1763 Elston Avenue CHICAGO, ILL.



## Everedy Efficient Hoists at an Economical Price

Increased convenience in shop transportation keeps things moving—prevents time waste and breakage.

Everedy Hoists (size shown) weigh 225 lbs., lift 500 lbs., cost \$225. Send for details.

Chain  
Hoists  
Cranes  
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Systems

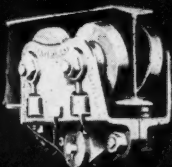
MANUFACTURED BY  
**READING CHAIN & BLOCK CORP.**  
READING, PA., U. S. A.



Chisholm-Moore manufactures a complete line of overhead material-handling equipment. Below are a few C-M Products. The catalog describes them all. Write for it.



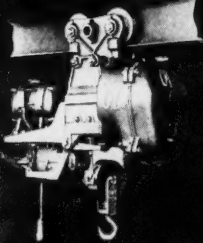
Model K Cyclone



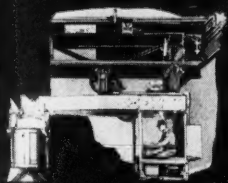
Matchless Trolley



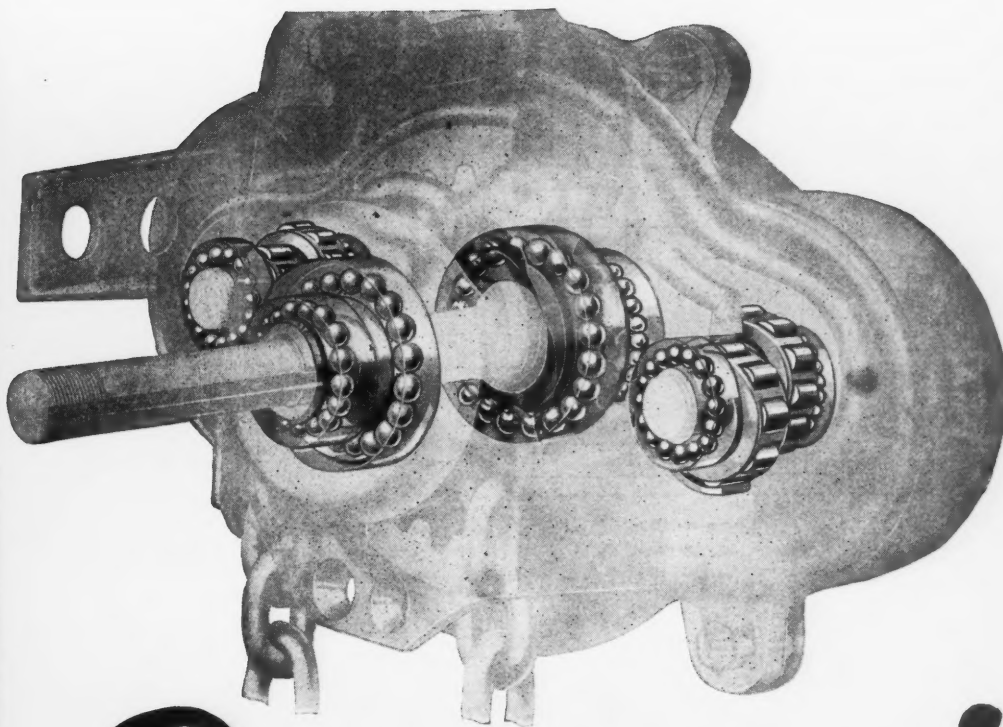
Double I-Beam Crane



Electric Hoist



Cupola Charging Machine



# Bearings!

**B**EARINGS that make it possible to lift the load with 18% less effort; bearings that reduce the hoist friction 50%; bearings that enable your men to do more work in less time and do it easier.

Altogether there are 12 anti-friction bearings in the C-M Model K Cyclone—two special ball bearings on the load wheel shaft, two special ball bearings on the hand wheel shaft, four special eccentric journal ball bearings, and four Rollway roller bearings on the eccentric shafts—all are self-retaining. There is also a Timken thrust roller bearing in the lower swivel hook.

No other high speed hoist is so completely equipped with anti-friction bearings. That is why no other high speed hoist can be as efficient, as economical or as easy to operate as a C-M Model K Cyclone. A completely descriptive Bulletin will be sent gladly, on request.

THE CHISHOLM-MOORE HOIST CORPORATION  
Division of Columbus McKinnon Chain Co.  
5038 Lakeside Ave., Cleveland, Ohio

Branches: New York Philadelphia Chicago Pittsburgh  
Representatives in all principal Cities for Quick service

**CHISHOLM-MOORE**  
CHAIN HOISTS CRANES TROLLEYS CUPOLA CHARGERS ELECTRIC HOISTS

The Chisholm-Moore Hoist Corp.

5038 Lakeside Ave.,  
Cleveland, Ohio

Please send us bulletins describing your

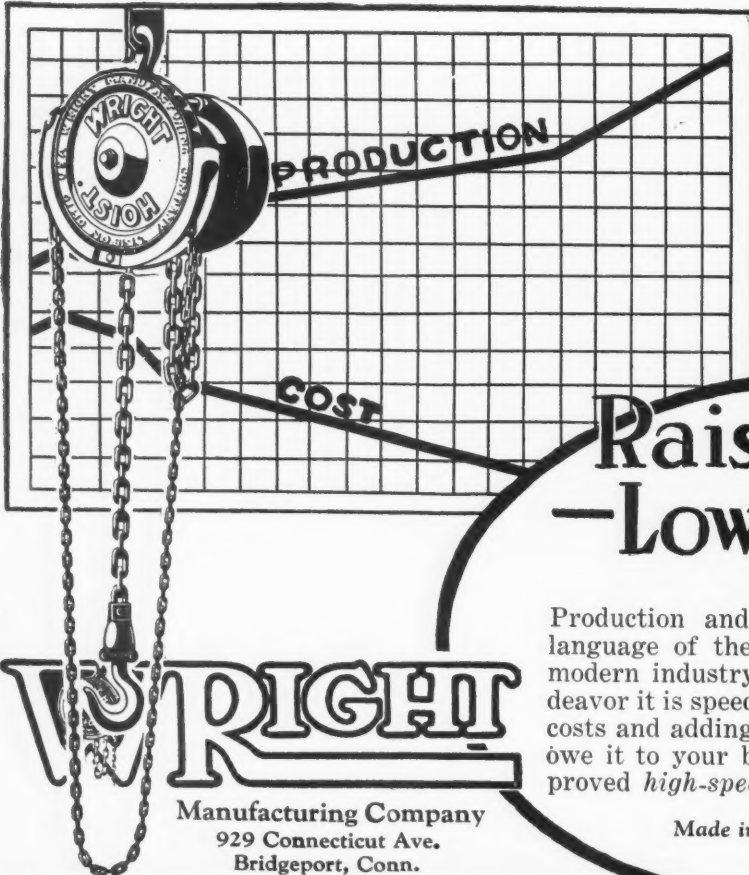
- ☐ Model K Cyclone Hoist  
☐ Electric Hoist  
☐ Other material handling equipment

Individual \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_



**WRIGHT**  
Manufacturing Company  
929 Connecticut Ave.  
Bridgeport, Conn.

## Raising Production —Lowering Costs

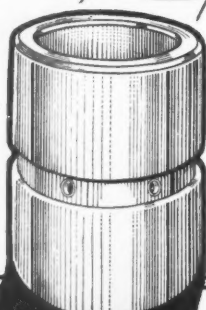
Production and cost charts tell in unmistakable language of the value of this "new day" hoist to modern industry. In every phase of industrial endeavor it is speeding up production, halving handling costs and adding to the safety of the workers. You owe it to your business to investigate the new improved *high-speed* Wright.

Made in all types and capacities. Let us tell you about them.



**BUCKEYE** Bearings, Bronze Bars, Bushings, etc. — service supplies that increase manufacturing profits.

"Quality is making us Famous" — investigate the reputation behind our slogan, then send for the Buckeye Service Stock List and weight chart of bronze bars.



*The* **BUCKEYE BRASS & MFG. CO.**  
6410 Hawthorne Ave.  
Cleveland, O.

Chicago Representative: Tool Equipment Sales Co., 18 S. Clinton Street



## Lift Electrically

Why pull—tug—strain and waste your time with slow lifting methods when the **ROEPER TYPE "R"** Electric Hoist will do the work twenty times as fast?

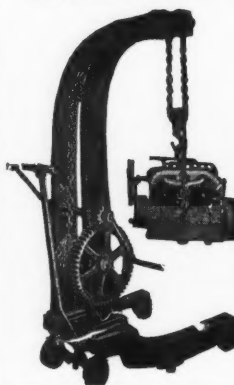
The price is surprisingly low. Send for Bulletin.

**ROEPER CRANE & HOIST WORKS, Inc.**

Member of Electric Hoist Manufacturers Association  
1740 N. 10th Street, READING, PA.

## Canton Portable Cranes

### Handy Time Savers

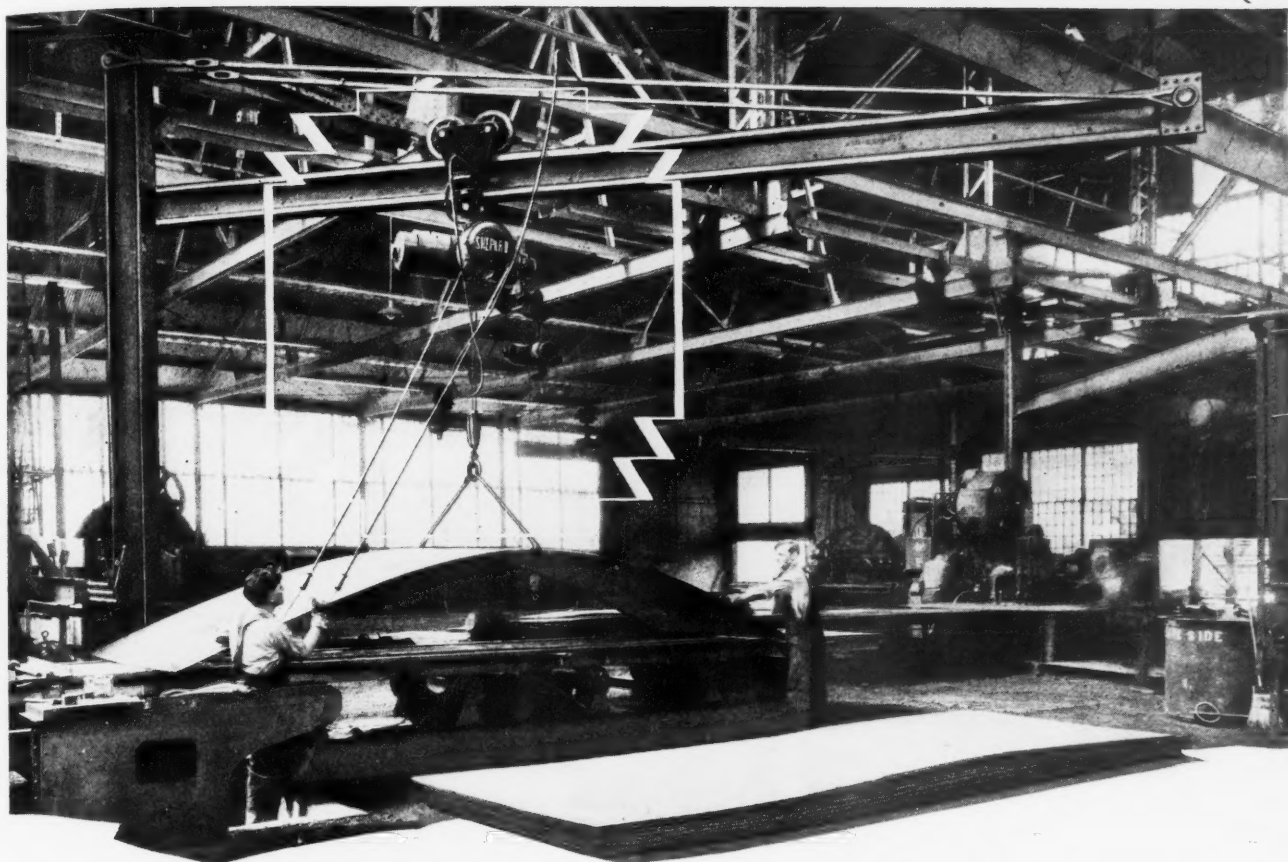


Castings can be turned over, heavy work loaded on and off machines etc., easily and quickly with a Canton Portable Crane. One man alone can operate it—the Safety Friction Load Brake prevents load slipping, saving accidents. Moves anywhere, handles loads up to 6000 lbs. Saves its cost many times over. Let us send details.

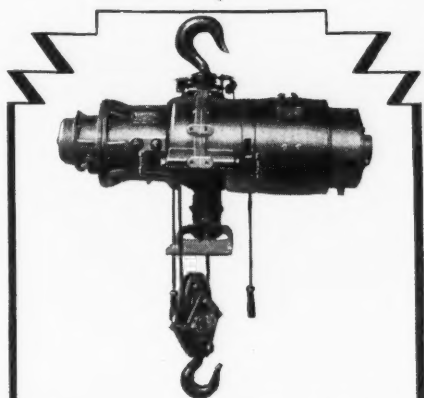
**Canton Foundry & Machine Co.**

CANTON, OHIO

New York Office, 203 E. 15th St.



## Top-notch machine production maintained with Shepards



*This lug suspension hoist used on a Jib Crane at the Chicago Bridge & Iron Works is but one of more than 5000 types and sizes with which Shepard is serving industry.*

*Shepard also builds Floor Operated Hoists—Cage Operated Hoists—I-Beam, Jib and Bracket Cranes—Transfer Cranes—Traveling Cranes—Cupola Chargers—Shepard Track and Switches, Winches*



Lifting and adjusting the heavy, unwieldy, steel plates for the automatic punch presses at the Chicago Bridge & Iron Works has been speeded by floor controlled Shepard Electric Hoists mounted on jib cranes. These unfailing, untiring mechanical helpers keep the expensive presses at top notch production.

Up from the floor to the machine bed, then a slight shift to the left or right—every motion of the load is under perfect control of the operator.

Every machine throughout the shop is served by a Shepard. Within the tightly sealed housings of Shepard Electric Hoists there is a balanced efficient mechanism completely protected from dust, dirt, dampness and fumes. Lubrication is automatic. The trustworthy day-in and day-out service that modern industry demands, is assured.

Shepard Hoists are sold to you by men trained in the efficient application of electric hoists and cranes. Their experience is at your service.

**SHEPARD ELECTRIC CRANE & HOIST CO.**  
380 Schuyler Ave., Montour Falls, N. Y.

*Branches in Principal Cities*

*Largest Manufacturer of Electric Hoists in America*

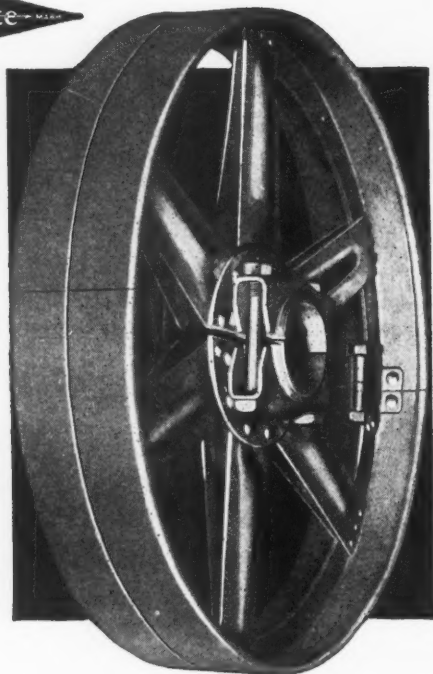
*Member Electric Hoist Manufacturers Association*

# SHEPARD

**ELECTRIC CRANES & HOISTS**



80 Million Gillettes  
4 Billion Blades



## "American" Pulleys helped make them

Shaving faces and shaving costs.

The fine quality and low price of Gillette products are a tribute to modern manufacturing methods—to a painstaking attention to every detail of plant equipment making for more efficient and economical operation.

"American" Steel Split Pulleys have long been a part of Gillette's plant equipment.

In fact, a list of the plants in which nearly seven million "American" Pulleys are contributing valuable power, time and labor savings would read like a "who's who" of world industry.

Do you know the "American" features that are responsible?

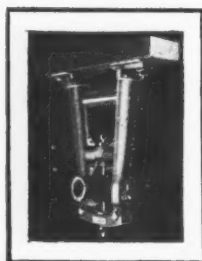
Let us tell you.

**The American Pulley Company**

**PRESSED STEEL:**  
PULLEYS HANGERS HAND TRUCKS  
MISCELLANEOUS STAMPINGS

4200 Wissahickon Ave. - Philadelphia, Pa.

For nearest distributor, see MacRae's Blue Book



**AMERICAN**  
PRESSED STEEL | STEEL SPLIT  
**HANGERS | PULLEYS**  
PATENTED PATENTED

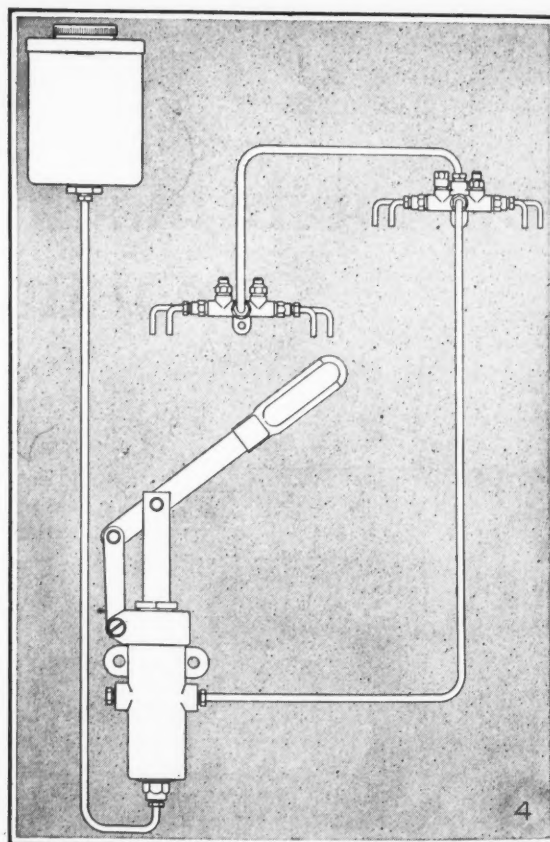
# BOWEN SYSTEM

of LUBRICATION

for

## INDUSTRIAL MACHINERY

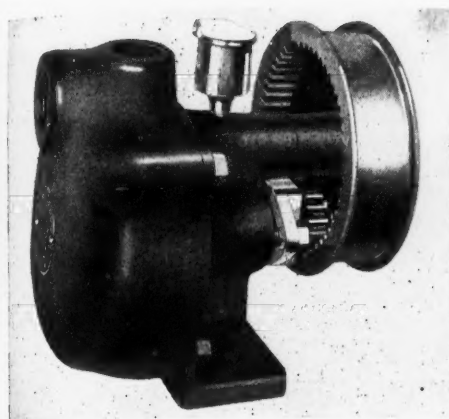
Makes the job of lubricating your machines as simple and easy as starting. A push on the plunger and every bearing, formerly oiled by hand, receives the proper, predetermined amount of oil—automatically and simultaneously.



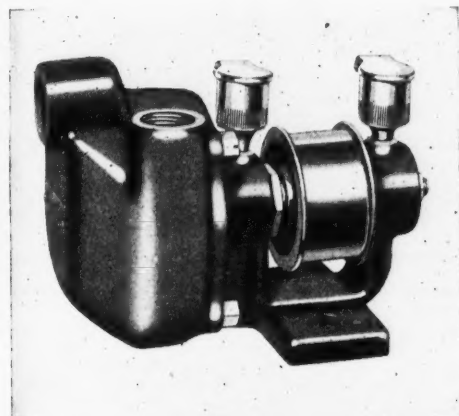
This diagram illustrates the principles of one of the several arrangements possible with the Bowen System.

Folder H-66 illustrates other arrangements and fully describes the system—Write for it.

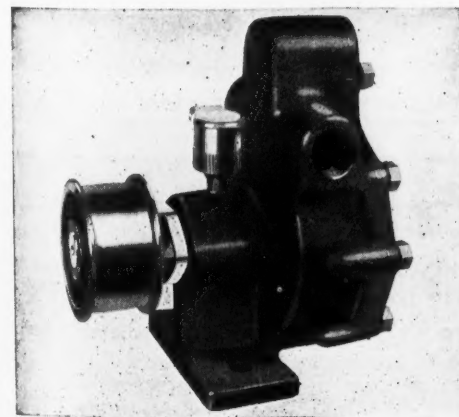
**Bowen Products  
Corporation**  
Auburn, N. Y.



**ROSS 2-WAY PUMP**—For machines which reverse the direction of countershaft rotation. Requires no priming except at installation. Gears last indefinitely because they do not work in the solution. Has no check or relief valves. No strainer. Is not clogged by chips, dust or grit and does not need cleaning. Delivers cooling fluid evenly. Amount may be regulated from off to full by turning outlet pipe valve. Adaptable to side, top or bottom suspension. Capacity 10 to 20 gallons at a speed of 300 to 600 R. P. M. Also supplied in direct drive design. Price \$15.00.



**ROSS CENTRIFUGAL COOLANT PUMP FOR GRINDING MACHINES**—A compact non-clogging one-way direct-drive pump of unusual ruggedness for Norton, Brown & Sharpe, Landis, Cincinnati and other grinders. Patented design of outlet-throat and curved impeller blades give maximum flow and efficiency. Impeller operates high above sediment level, delivering fluid to work in a cleaner condition. Full-size bronze bearings located outside of solution, two large lubricating cups and hardened and ground shaft insure maximum wear. No priming or cleaning required. Easily applied and adaptable to top, bottom or side suspension. Unconditionally guaranteed for one year. Price \$15.00.



**ROSS SLOW-SPEED PRESSURE MACHINE PUMP**—A pressure pump adaptable to machines requiring a suction lift of 12 inches or more and with slow countershaft rotation. Has an automatic relief mechanism. Will not clog with grit, chips or dust. Requires no cleaning. Has bronze bearing of the gland type, sealing the pump chamber by drawing up on two bolts. Lubricated through single, large oil cup. Shaft hardened and ground for maximum wear. Capacity at 400 R. P. M., 7 gallons—at 850 R. P. M., 12 gallons. Sold, like other Ross Pumps, with unconditional guarantee for one year. Price \$15.00.

## Cut Costs with ROSS PUMPS

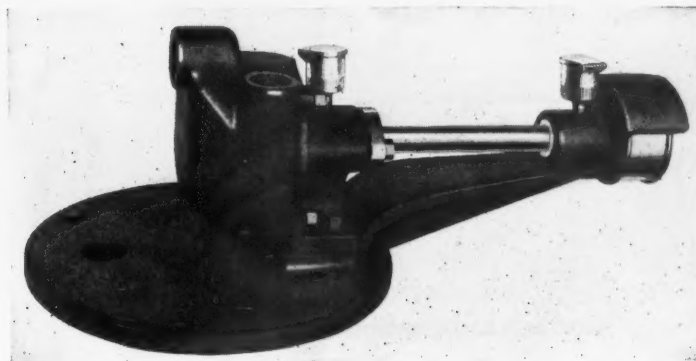
**T**HE cost of constantly cleaning old-style "circulating systems" soon mounts to many times the price of modern, non-clogging Ross Cooling-fluid Pumps. Time and money now spent on the frequent replacing of grit-worn pump gears and other parts is saved for productive work when you bolt on a Ross. The output of your machines is held at maximum because each Ross delivers the fluid in the right volume and at the correct pressure for the job to which it is applied.

Non-clogging, requiring no priming, built for long service with little attention, unconditionally guaranteed for one year, you will find that Ross Pumps fill the needs of modern manufacturing. Try one Ross of each type to start with. Compare its performance—and "watch your pumping costs go down!"

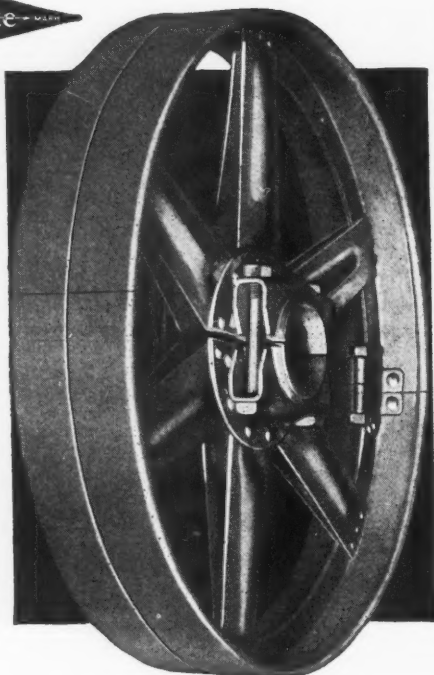
*The*  
**Ross**  
Mfg. Co. Cleveland, Ohio U.S.A.

Also manufacturers of Ross Master-truing Tools and Emery-wheel Dressers.

**ROSS CENTRIFUGAL PUMP FOR NO. 10 and 11 B. & S. GRINDERS**—The outstanding feature of this gearless pump is that it is mounted on top of the grinding machine, no moving part operating in the semi-abrasive fluid. Therefore it has practically no wear-out, with occasional lubrication of the two bronze bearings through the large oil cups. The pump is non-clogging and requires no priming. The intake pipe is six inches from the bottom of the tank, taking in and delivering the fluid almost grit-free. This Ross Pump can be installed in twenty minutes without extra parts. It weighs one-third as much as the regular pump, and has an equal or greater capacity. Price \$25.00.



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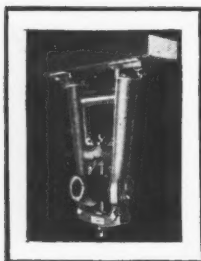
**The American Pulley Company**

PRESSED STEEL:

PULLEYS HANGERS HAND TRUCKS  
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**AMERICAN**  
PRESSED STEEL | STEEL SPLIT  
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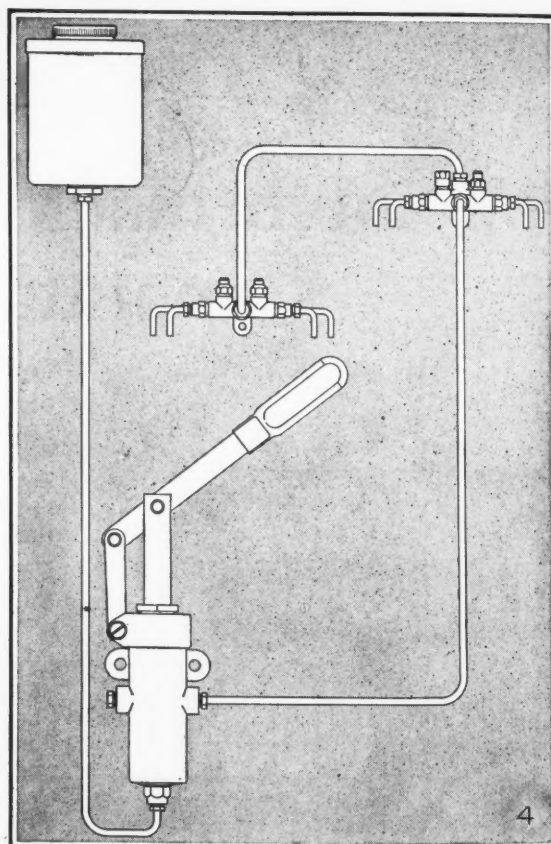
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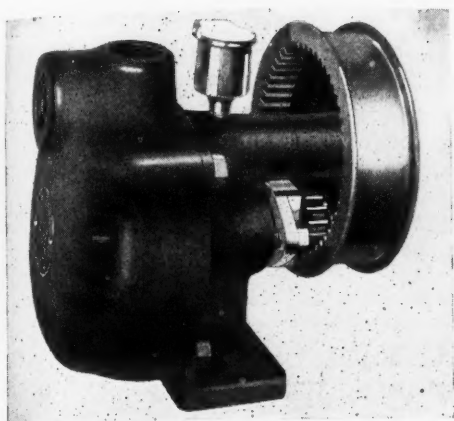


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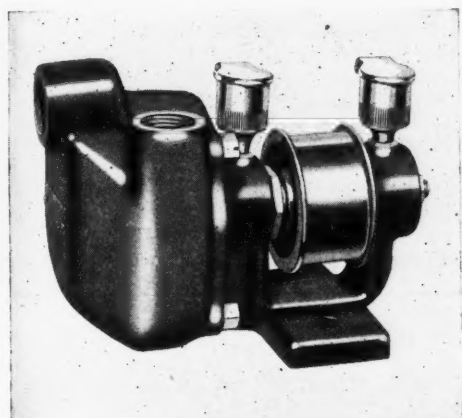
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**Bowen Products  
Corporation**  
Auburn, N. Y.

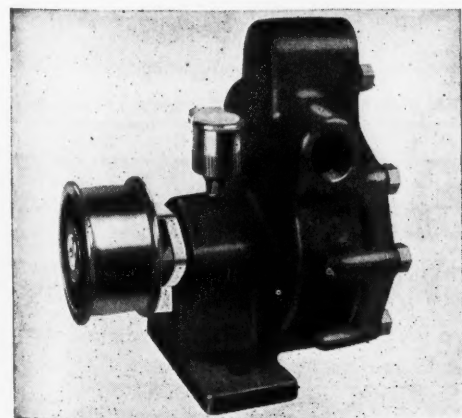




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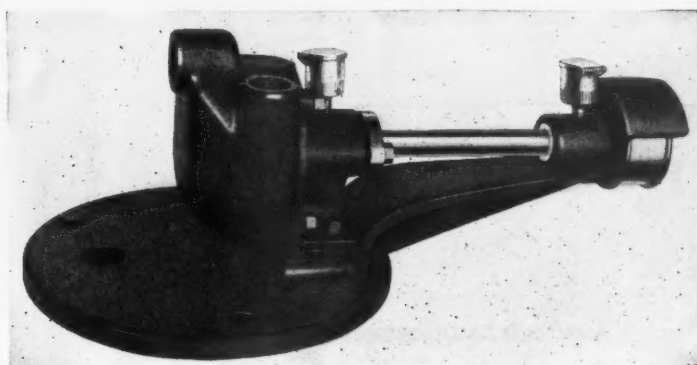
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No. 250 W Typhoon Washer

## TYPHOON WASHING

### for Screws and Screw Machine Parts

Small parts of a size that will lie in quantities in a basket of one or two bushels capacity can be washed and dried in the Barrett Typhoon Washer at a production rate fast enough for the busiest shop. The washing solution is distributed through the parts by centrifugal force, and is under the control of the operator at all times. One or more solutions may be run through successively: soda water, rinsing water, a coating solution, etc. Should hot air be desired, the electrically heated Cyclone Dryer grid may be attached.

Two sizes—3824 cubic inches and 1440 cubic inches.  
Catalogs and all details upon request.

**THE LEON J. BARRETT COMPANY**

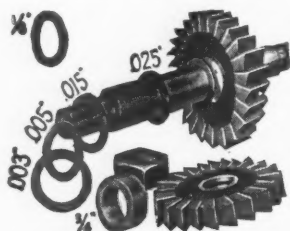
1475 Grafton Street

CENTRIFUGALS

Worcester, Mass., U.S.A.

## Steel Spacing Washers

Send for free assortment in the sizes you use most.  
Stock sizes for arbors of the following diameters:



$\frac{3}{8}$ ,  $\frac{1}{2}$ ,  $\frac{5}{8}$ ,  $\frac{3}{4}$ ,  $\frac{7}{8}$ , 1,  $1\frac{1}{8}$ ,  
 $1\frac{1}{4}$ ,  $1\frac{1}{2}$ ,  $1\frac{3}{4}$ ,  $1\frac{7}{8}$ ,  $2$ ,  $2\frac{1}{4}$ ,  $2\frac{1}{2}$ ,  $2\frac{3}{4}$ , 3,  $3\frac{1}{4}$  and  
4 inches and larger.

Stock Thickness: .001, .002,  
.003, .004, .005, .006, .007,  
.008, .010, .012, .015, .020,  
.025, .032, .047, .063, .093,  
and .125 inch.

Spacers thicker than  $\frac{1}{8}$ " are  
turned from tubing but not  
carried in stock.

**DETROIT STAMPING CO.**

3445-3459 West Fort St.

DETROIT, MICH.



## GUSHER PUMPS

PERFECT in their SIMPLICITY

"Gushers" are the most perfect and most durable pumps made because of their simplicity. They have no troublesome complications—no foot or relief valves—no packing nuts—need no priming—and grit, dirt and small chips pass through without injuring the mechanism. Easily installed, wonderfully efficient, they stand the wear and tear of time.

Write for complete Catalog today

**The Ruthman Machinery Co.**

Model U-L-O

Front and Pike Sts.

Cincinnati, Ohio

Style G

Opened

Style G

Style A

Style C

Style B

Style D

Style D

**TUCKER**

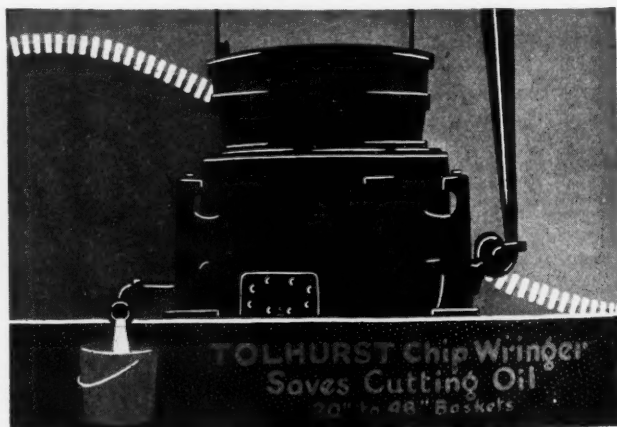
**Oil Hole Covers**

ALSO  
SHEAR AND ROD CUTTERS  
AND  
SCREW MACHINE PRODUCTS

A Type for Every Service  
SEND FOR REVISED CATALOGUE

**W.W. & C. F. TUCKER, Inc.,** 611 Capitol Ave.  
Hartford, Conn.

FOREIGN AGENTS: Fenwick Freres & Co., Paris, France.  
Alfred Herbert, Ltd., Yokohama, Japan.

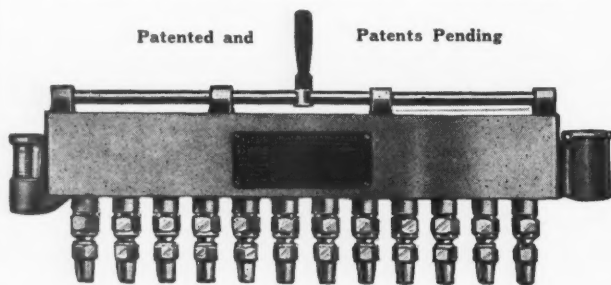


**TOLHURST MACHINE WORKS, Est. 1852, Troy, N. Y.**

### Another Gits Lubrication Achievement

Patented and

Patents Pending



"Correct Lubrication—More Sales"

## MULTIPLE LEAD WICK FEED OILER

10 Sizes—3 to 12 Leads

A moderate priced absolutely automatic feed oiler that lubricates positively and economically numerous bearings from a central point.

Send for Descriptive Folder

**GITS BROS. MFG. CO.**

Hawthorne Station

CHICAGO, ILL.

# Add Life to Cutting Tools



**DELCO CUTTING OILS** actually prolong the life of cutting tools — because they are technically compounded to have just the right viscosity and lard-oil content.

By blending pure mineral oils with our own Delco Concentrated Base (high in specially treated fats) we get oils that successfully handle the terrific friction loads of cutting operations. Cutting tools are kept cooler, and cutting costs kept lower.

No matter what your oil or grease requirements may be—for cutting, drawing, or machine lubrication—we are prepared to serve you satisfactorily, with stock or special lubricants. Try Us!

**LINDSAY-McMILLAN CO.**

Chicago 1605 Kimball Bldg.  
Milwaukee Branch Offices: Detroit 3131 Bellevue Ave.  
Minneapolis Central Warehouse Co. Duluth Glencoe Bldg.

**Delco**  
REG. U.S. PAT. OFF.

**LINDSAY-McMILLAN CO**

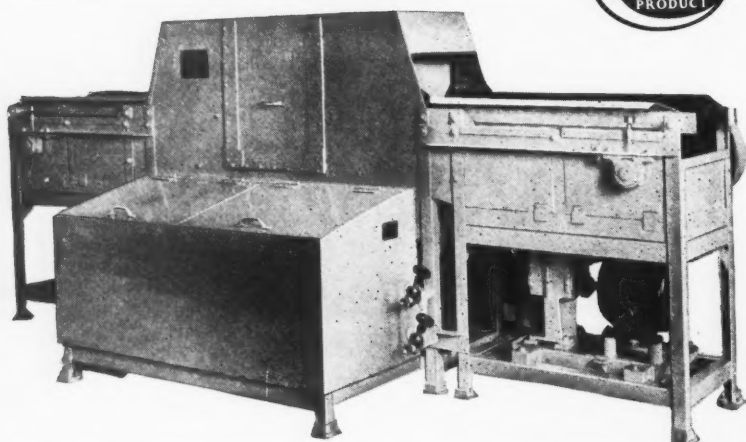


## CUTTING OILS

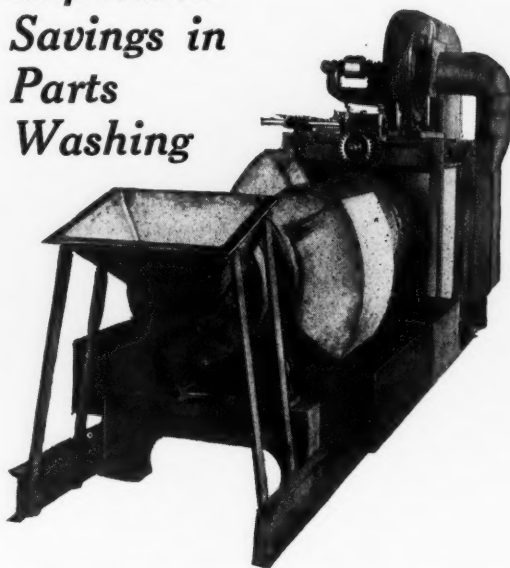
*"If it's Lubrication it's OUR Problem"*



# COLT AUTOSANS



*Important  
Savings in  
Parts  
Washing*



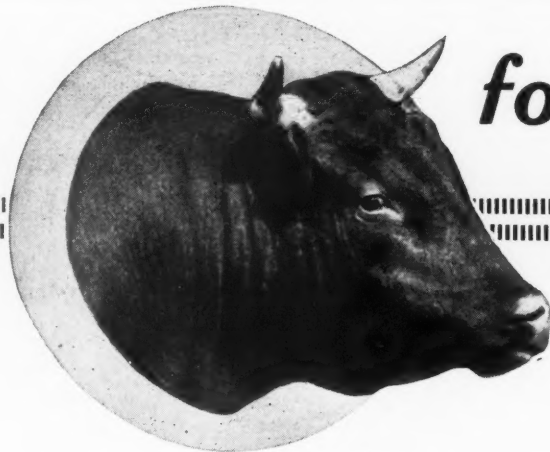
Colt Autosans offer the manufacturer a method of washing metal parts which saves 50% to 75% of the cost by usual methods. Revolving Type Autosans handle small parts in bulk. These machines operate automatically from the dumping of the work into the loading hopper until it is discharged clean and perfectly *dry*. Dissimilar parts can be put through without mixing—several different solutions used if desired. Conveyor Type Autosans wash heavier parts such as cylinder blocks, castings and stampings. Work goes through rapidly and is perfectly cleaned and rinsed by jets of steaming solution or water which reach every point.

Both types are economical of power, labor and solutions. Both are rugged and seldom require attention. Send us your questions—or ask us to have our Engineers make a survey of your cleaning problems.

**Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.**

## Stands

## for Service



The Ajax Bull is representative of better bearings, longer service—he “stands for service” to all who use Ajax Bull Bearing Alloy.

This new folder “Stands for Service” explains why users can expect longer life from bearings lined with Ajax Bull Bearing alloy, and how they get it.

*Send for this latest Ajax circular.*



**THE AJAX METAL COMPANY, PHILADELPHIA**

Established 1880

NEW YORK

CHICAGO

CLEVELAND

# POOR Lubrication costs one company \$10,000. A MONTH

**It Costs Other Companies Less—but Too Much. The Question of Lubrication Deserves Greater Executive Attention. Read How Other Concerns are Plugging Up the Leaks.**

Have high officials become too accustomed to the expenses incident to repairs and delays when bearings seize or fail?

Have they fallen into the habit of assuming that such things *must* happen?

In *your* plant perhaps you recently installed an improved lubrication system.

It has bettered the situation, yes—but enough?

With your tremendous investment in machinery, you cannot achieve bed-rock economy with anything

short of the best protection to the life of bearings.

In this competitive era, with the pressure ever constant for "lower production costs," you cannot afford to overlook a single factor.

Balcrank builds lubricating specialties—a complete line—designed to overcome lubrication problems better than any equipment which has been available to you.

Recommendations are made only after a careful consideration of your special requirements.

**Complete Balcrank Lubrication Service**  
Ask to have a Balcrank Industrial Lubrication Man call, without obligation, and *demonstrate* the cost-lowering, efficiency-increasing advantages of the complete line of Balcrank Lubrication Units. The Cincinnati Ball Crank Company, Cincinnati, Ohio.

## BALCRANK

TRADE MARK REGISTERED

### INDUSTRIAL LUBRICATION UNITS

Automatic Lubricators—Nipples—Chucks—Grease Pumps. Also Hand, Foot and Power Operated Grease Guns manufactured under license from Bassick Mfg. Co., also Balcrank patents and patents pending.



**Balcrank Hand Gun**

Balcrank hand guns are sturdily and carefully constructed for heavy duty. They are filled by suction or from a large gun or pump. Compressor leathers in opposite directions insure powerful suction action for refilling and high compression.

Practically any lubricant from No. 3 cup grease or fibre grease to kerosene can be used successfully in these guns.



**Balcrank Nipples**

Balcrank patented one-piece nipples are made from solid steel without cross-pins or threads where chucks are attached.

Note tapered end and broad surface for chuck jaws to grip—high pressure cannot force off the chuck. Only a release of chuck jaws will remove chuck from nipple. Balcrank nipples are strengthened against breakage by their rounded bearing ends.



**Balcrank Chucks**

Speed! Safety! With a  $\frac{1}{8}$  turn of the gun, the operator locks or releases the Balcrank Automatic Explosion Chuck upon the hexagon part of a Balcrank nipple. He need not reach his hand into moving parts. Turning the gun handle builds up pressure before attaching to nipple. Upon release, an automatic valve stops the flow of grease. No waste or mess from leaking chucks and nipples.

There are other Balcrank Chucks for use with revolving nipples, with or without flexible hose, etc.

THE CINCINNATI BALL CRANK CO.  
Cincinnati, Ohio.

Kindly send full particulars and arrange for a demonstration, without obligation, of Balcrank Industrial Lubrication Units.

Firm.....

Address.....

Signed by..... Machinery, Aug.-28



Double Seamer  
for can making  
equipped with  
C-H Motor Control





# Faces change in your customers' plants —as in the old home town

*What features of quality establish  
confidence for your product?*

**B**ILL JONES may not be buying equipment for your good customer a year hence. His successor may have different ideas—different preferences.

But if each machine you sell has an outstanding, well-known and accepted feature, your problem of holding this customer's business is simplified.

Cutler-Hammer Motor Control is *such* a feature—favorably known everywhere, by executives and workmen alike.

It is the accepted standard of motor protection—welcomed on any machine for the handling ease and efficiency it assures—because of these facts, C-H Control is an added guarantee of the care with which you have designed and manufactured your entire machine.

For designing new motor-driven machines or improving present models, making them more readily accepted by new customers and old, Cutler-Hammer experience is yours for the asking.

The CUTLER-HAMMER Mfg. Co.

*Pioneer Manufacturers of Electric Control Apparatus*

1204 St. Paul Avenue  
MILWAUKEE, WISCONSIN

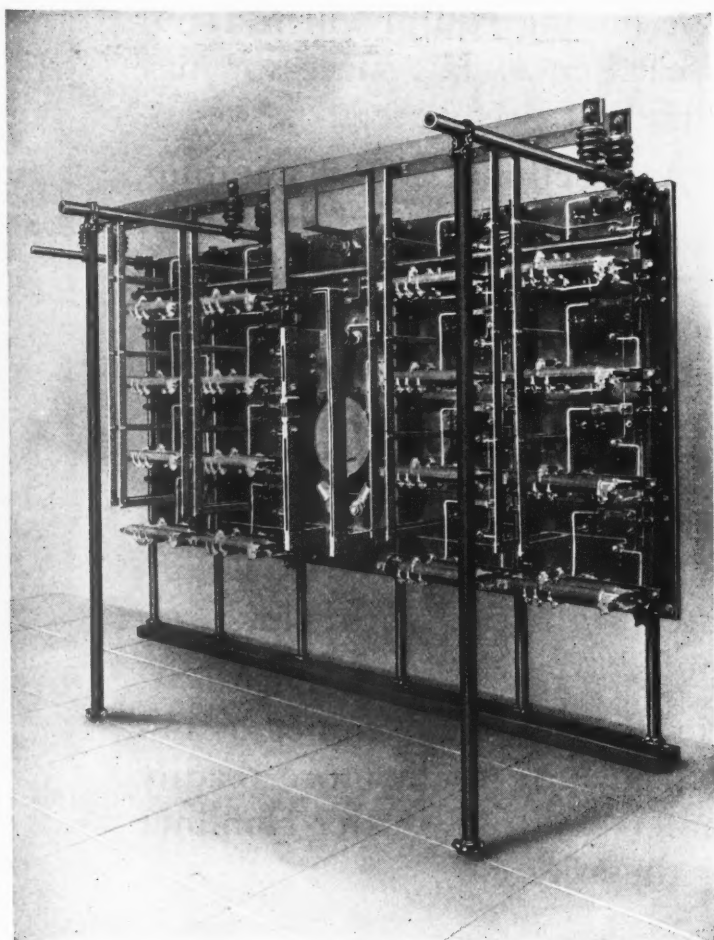
## CUTLER HAMMER



*The Control Equipment Good Electric Motors Deserve*

(1204)

# *They wanted permanently constant resistors* **Monitor** did it with Edgewound



*Rear view of Hertner battery charging panels  
equipped with Monitor Edgewound Resistors.*

## **E**EDGEWOUND

Resistors are made up of units, each one consisting of a nickel-alloy ribbon wound on edge in helical form and mounted on a steel-reinforced porcelain support. The steel support gives strength, the porcelain furnishes insulation and holds the ribbon in place. There is no mechanical strain on the resistive conductor and it can operate at any temperature up to red heat without sagging or injuring the resistor as a whole.

Edgewound is light, flexible, practically unbreakable, and has a constant resistance.

Bulletin 111 describes the full line of Monitor Resistors, Edgewound, Hexwound and Smoothwound. Write for it.

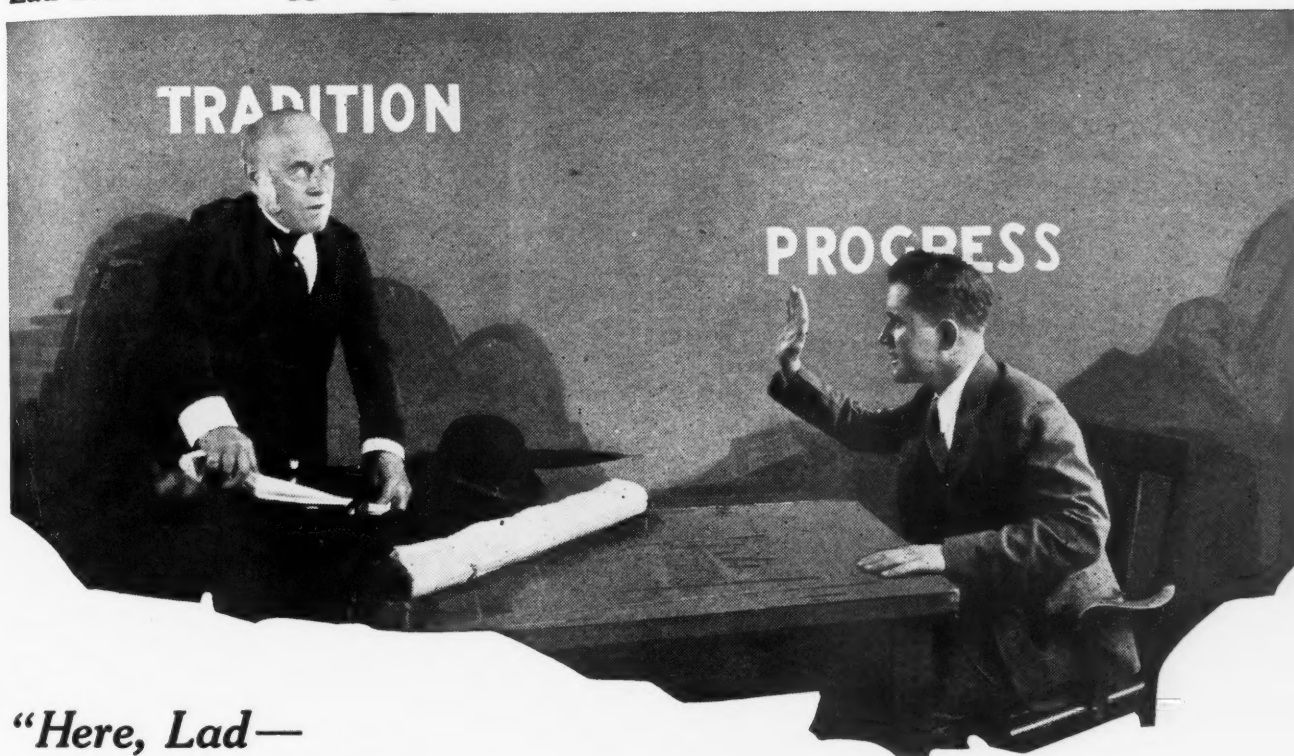
MONITOR CONTROLLER COMPANY  
Gay, Lombard and Frederick Sts., Baltimore, Md.

IF YOU HAVE A RESISTOR PROBLEM . . . PUT IT UP TO MONITOR

# **Monitor** *resistors give 100% service*

82-6236-1

Lad defines sense egg-actly



**"Here, Lad—**

I've just been talking with the man from whom I've bought motors for years.

I told him what you said about every going and growing factory in our vicinity throwing out cast iron motors and standardizing on 'Linc-Weld' STEEL motors, so I asked him why it was.

He told me that it was 'Linc-Weld' departures from general practice that captured people—but he confidentially advised me that the so called improvements had no sense to them at all."

**"Linc-Weld" Superiority  
is due to:**

1. Larger Shafts
2. Larger Bearings
3. Better Insulation
4. Stronger Frame (Steel)
5. Greater Overload Capacity

The Lincoln Electric Co., Dept. No. 7-8, Cleveland, Ohio

M-18

**"Sure, Pop—**

not from his dim viewpoint.

You'd hardly expect your grocer to tell you that his competitor's eggs were fresher than his. And if he had your motor maker's type of thinking, he'd stand up for those eggs until they hatched—while the progressive dealer took his trade.

It's the USER who sees the sense in 'Linc-Weld.'

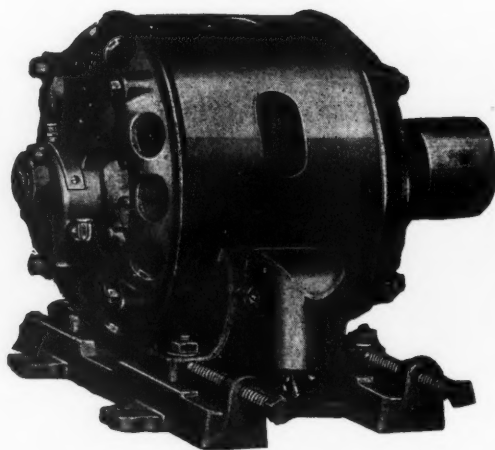
Of course, your man can't see any sense to 'Linc-Weld' double size bearings, while he's still sticking to the peanut size. But the factories around here report a fine clean-up of bearing failures since they sensed the sense of it.

Of course, your man can't see any sense in a steel frame, since he operates a grey iron foundry—but the factories I've visited have found in 'Linc-Weld' STEEL FRAME motors a means for obviating production let-downs.

Of course he can't see sense to it—Did you ever see a homely girl who wasn't willing to tell you that her pretty rival has no sense AT ALL?"

**L** **"Linc-Weld"**  
**INCOLN MOTOR**



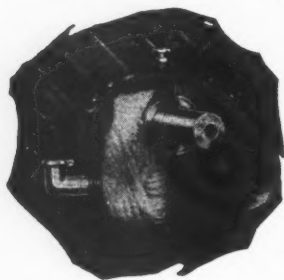


1 Horse Power Century Type RS  
Repulsion Start Induction Single Phase Motor

## For Electric Refrigerators Oil Burners and House Pumps

The ability of Century Type RS Repulsion Start Induction Single Phase Motors to continuously meet all of the service and power supply requirements of such installations as electric refrigerators, oil burners and house pumps, makes them the logical choice for these and other installations, especially where high starting torque and low starting current are desirable.

At least one year's continuous 24-hour-per-day operation, without reoiling, is assured by the Century Wool-yarn System of Lubrication. This is standard for 1 horse power and smaller motors.



They operate quietly. Static and running balance tests are applied to each armature, eliminating vibration to the greatest degree commercially practical . . . . Bearings are long lived. They are machined from phosphor bronze castings, the highest grade bearing material obtainable . . . . Ball bearings can be furnished when needed . . . . Brushes and commutators last. Brushes touch the commutator only during the starting period, about 1/900th part of the time the motor is operating.

*Built in standard sizes from 1/8 to 40 horse power.*

**CENTURY ELECTRIC COMPANY**

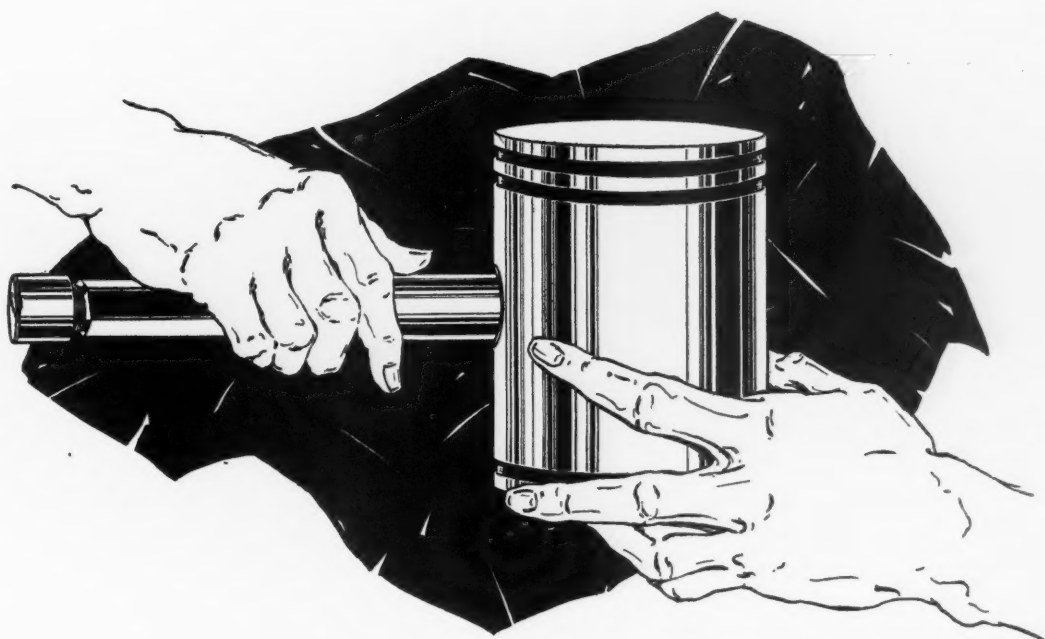
1806 Pine St.

St. Louis, Mo.

35 Stock Points in the United States and More Than 50 Outside Thereof



**“THEY KEEP A-RUNNING”**



## **High cleaning standards assure high inspection standards**

**W**ITHOUT thorough cleaning, proper inspection of machined parts is difficult. Foreign matter, machinings or compounds remaining on metal surfaces are a hindrance to accurate gauging. Half-way cleaning imposes a handicap on precision manufacture.

To assure thoroughly clean work before inspection, it is standard practice with hundreds of shops to use Oakite materials. Like keen-edged tools, these powerful cleaning materials cut through oil, grease, lapping, cutting and grinding compounds until they have searched out and removed every last particle. They are down-to-the-metal cleaners—producers of consistently thorough cleaning, day in and day out.

*Oakite Service Men, cleaning specialists, are located in the leading industrial centers of the U. S. and Canada.*

There are Oakite materials for doing every metal cleaning operation in this precision way. Oakite Service Men are always at your disposal for their application to your work.

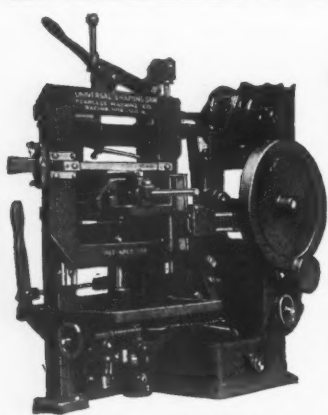
Manufactured only by

OAKITE PRODUCTS, INC., 26 Thames St., NEW YORK, N. Y.

# **OAKITE**

TRADE MARK REG. U. S. PAT. OFF.

## ***Industrial Cleaning Materials and Methods***



The Peerless High Speed Universal Shaping Saw.

## Peerless Metal Sawing Machines

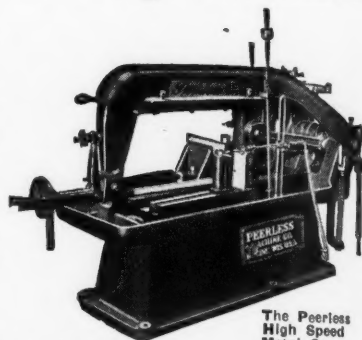
Reduce waste by cuts so accurate that second operations are usually not required before machining such parts as gear blanks, etc.—and this at higher speed than is usual on such work. A big claim, but it stands investigation.

Send for details of Peerless High Speed Saws, ask also about Peerless U. S. A. Power Blades and Peerless Hand Blades.

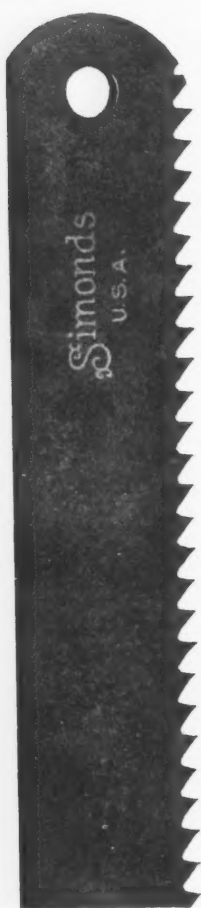
**Peerless Machine Company**

1218 Sixteenth St.,

RACINE, WIS.



The Peerless High Speed Metal Saw.



### A Hack Saw Blade that Gives Six to Ten Times More Production

More hack saw service, faster feed and faster speed in metal cutting are reasons why the new **Simonds Red Streak High Speed Steel Hack Saw Blade** is being adopted by factories where production is essential. This is the new blade that gives from six to ten times as much work as the regular tungsten blade.

It cuts fast and stands more feed. Order from any Simonds Factory or service station.

**Simonds Saw and Steel Co.**

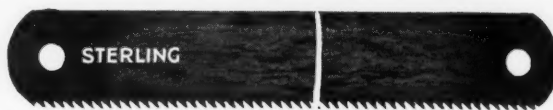
"The Saw Makers"

ESTABLISHED 1832—FITCHBURG, MASS.

Chicago, Ill.    Memphis, Tenn.    Seattle, Wash.  
Boston, Mass.    Atlanta, Ga.    Montreal, Que.  
Detroit, Mich.    London, England    Toronto, Ont.  
New York City    Portland, Ore.    Vancouver, B. C.  
New Orleans, La.    San Francisco, Cal.    St. John, N. B.  
Lockport, N. Y.    Los Angeles, Cal.

**Simonds Red Streak High Speed Steel Hack Saw Blade**

## STERLING



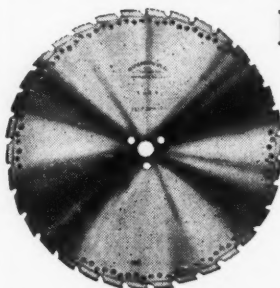
### HACK SAW BLADES

Quality for Over Quarter of a Century

ESTABLISHED 1898  
MANUFACTURED BY

**Diamond Saw & Stamping Works**  
BUFFALO, N. Y.

### Lowest Cost per Cut with HUTHER SAWS

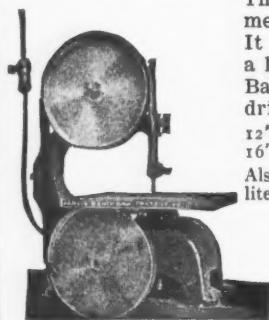


The special inserted teeth of high speed steel make Huther Saws profitable and economical. Inserts give  $1\frac{3}{4}$ " wear before replacing—and replacements cost but little. The saws are shaped to give proper clearance to the teeth at all times.

The Huther line covers saws for every purpose. You can try one at our expense. May we send it?

**HUTHER BROS. SAW MFG. CO., Inc.**  
ROCHESTER, N. Y.

### The "JARVIS" Bench Band Saw For Metal Cutting Operations



The "Jarvis" Bench Band Saw cuts metals—straight, curved or bevel. It is motor driven, operates from a lamp socket and is vibrationless. Ball bearing disc wheels, worm drive.

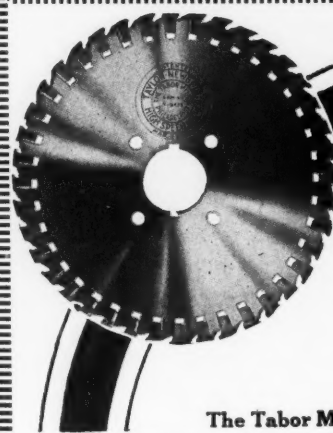
12" size cuts up to  $1\frac{1}{2}$ " cold rolled steel.  
16" size cuts up to 2" cold rolled steel.

Also made for cutting soft metals, Bakelite, fibre, transite, wood, etc.

Details gladly sent upon request.

**BENJ. E. JARVIS, Inc.**  
NEWARK    NEW JERSEY

Walls Sales Corp., Agents  
96 Warren St.    New York City



**DISC LAST INDEFINITELY**  
Specially treated teeth requiring infrequent grinding—quickly inserted.

**Taylor Newbold Inserted Tooth Cold Saws**

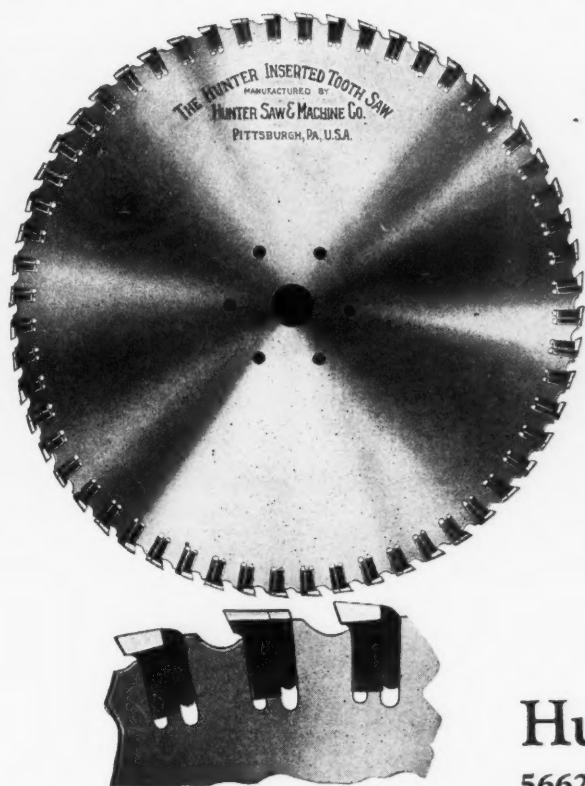
The Tabor Mfg. Co., Philadelphia, Pa.



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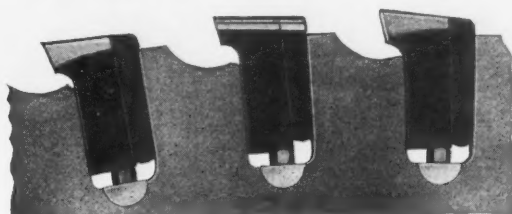
# Hunter Inserted Tooth Saws

## Lower Cutting Off Costs



Teeth bottomed on the body of the saw give rigidity equal to solid metal yet are easily removed and renewed when worn too far for resharpening.

Hunter Saws save steel, save money, give increased sawing efficiency.



Details of the Hunter Inserted Tooth Saw with independent nut and screw adjustment of each tooth.

Send for catalog of Hunter Inserted Tooth Saws.

**Hunter Saw & Machine Co.**

5662 Butler Street :: Pittsburgh, Pa., U. S. A.

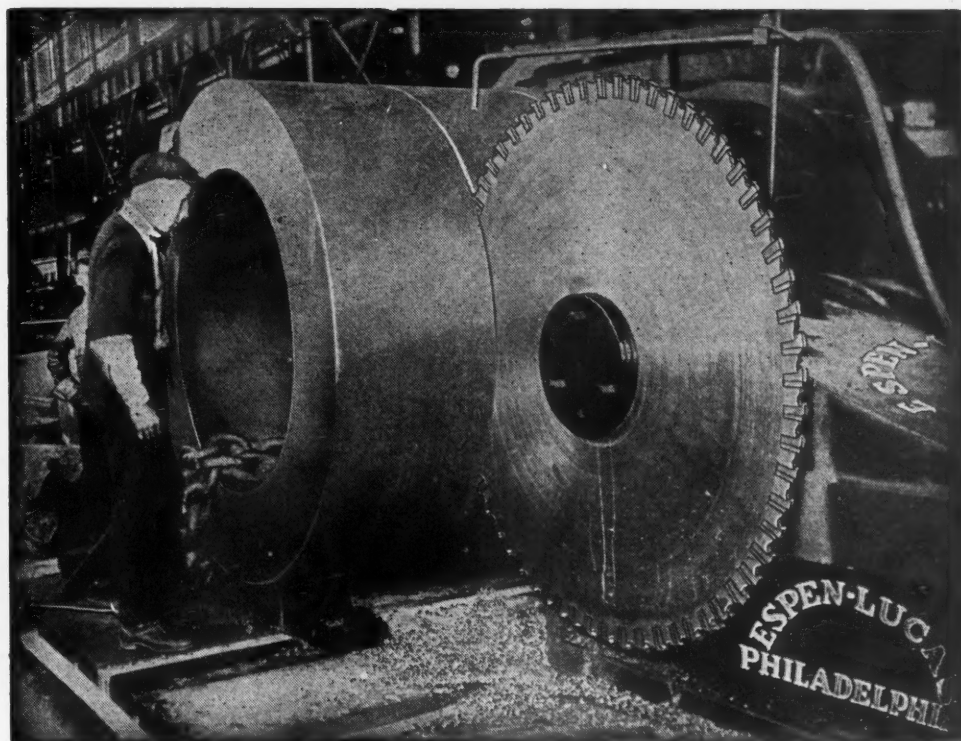
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## FAST AND ECONOMICAL SAWING

Tell us your needs, we have the knowledge, experience and will to correctly advise.

190 types and sizes of Sawing Machines for sawing all kinds of metal.



---

**THE ESPEN-LUCAS MACHINE WORKS,** Front St. and Girard Ave.  
PHILADELPHIA, PA.

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# Saw Metal Without Waste

## with Marvel Band Saw No. 8

In its ability to economize any sawing job, large or small, up to 18", the Marvel is all that its name implies. And it is not hampered in any way by the type of work. The Marvel cuts off square, and at any angle, right or left up to 45°, without special holding devices.

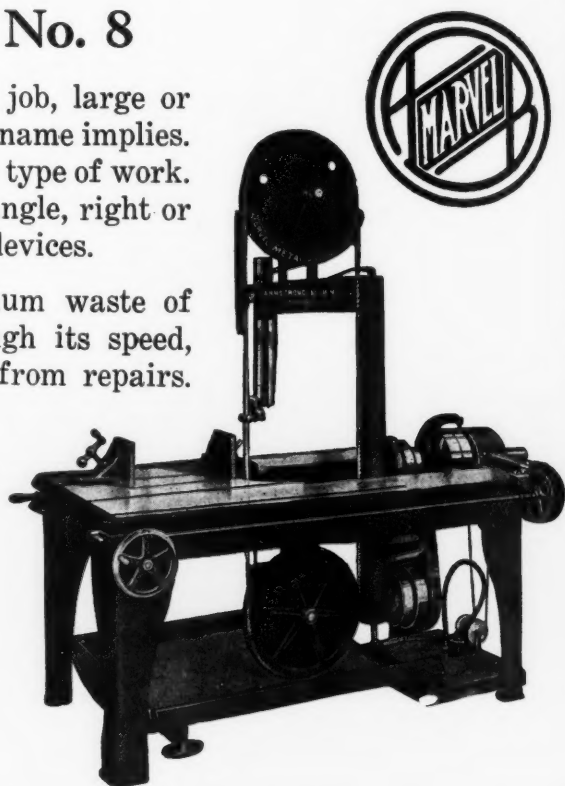
The Marvel No. 8 cuts with a minimum waste of metals, effecting further savings through its speed, convenience of operation and freedom from repairs.

Equipped with new feeding device which indicates the blade pressure in pounds.

*In writing for circular, ask for the big list of prominent users.*

**ARMSTRONG-BLUM  
MFG. COMPANY**

343 N. Francisco Ave., CHICAGO, ILL.



## The **HANDNIB**

**Cuts Template and Gauge-Making Costs a Full Tenth!**

**Fast  
Accurate  
Profitable**



**The "HANDNIB" Costs Only \$32.50—  
Does Better Work Than Machines Costing \$200 to \$300!**

Set it up in any vise, use it to cut sheet metal in any design *easily, accurately, quickly* by hand! It eliminates expensive machinery and laborious, uncertain, costly drilling. Ready in a minute—no mounting necessary. No other machine like it in the world—you must see it to believe it!



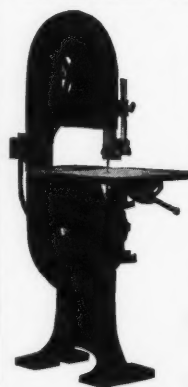
### Special Blades for Special Jobs

We can supply any shape of blade for your particular work. A few blades shown at left. Write for full information, stating requirements. Testimonials from prominent users on request. Don't be without this profit-maker another day—*write now!*

**NATIONAL MACHINE TOOL CO.**  
1536A Clark Street, Racine, Wis.

Standard Blade

## Crescent Wood Working Machinery



Save time in your pattern-shop by providing each workman with individual small Crescent machines. The line consists of band saws, saw tables, jointers.

The saving in time and the convenience to your men will be highly profitable to you. Ask for catalog.

The 20" Crescent band saw is one of the machines that will save money for you.

**THE CRESCENT MACHINE  
COMPANY**

56 Main St., Leetonia, Ohio, U. S. A.

WOOD  
CUTTING

# "LENOX"

METAL  
CUTTING



## BAND SAWS

*"The Tools in the Plaid Box"*

**AMERICAN SAW & MFG. CO. SPRINGFIELD, MASS.**

HACK SAWS - BAND SAWS - SCREW DRIVERS - GLASS CUTTERS

# Besly Disc Grinders

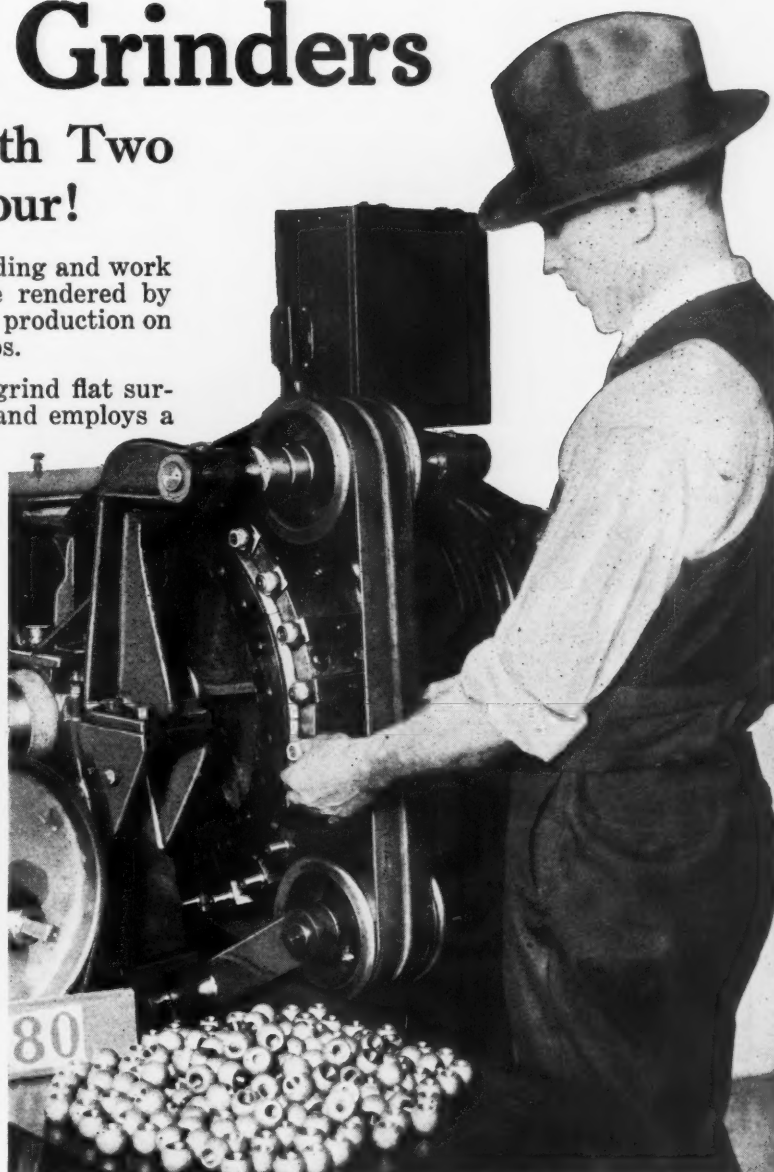
## Steel Balls Ground with Two Flats, 1300 Per Hour!

The design and construction of special loading and work holding fixtures is an important service rendered by Besly Engineers—resulting in remarkable production on otherwise slow and laborious grinding jobs.

The installation illustrated was built to grind flat surfaces on steel balls for universal joints, and employs a special holding device with a Besly No. 6-20"—I Type Wet Grinder with Direct Connected Motor Drive. Production is 1300 pieces per hour, ground both ends in one operation.

The work is slipped over hardened steel pins and clamped rigidly in fixed Vee slots in the feed wheel. This clamping is accomplished by means of a wide rubber belt running over pulleys as shown. As the feed wheel passes under the belt, the belt forces down the blocks from which the pins project, incidentally forcing the work into the Vee slot in feed wheel. As work leaves the grinding members, the belt pressure being released, it is easy to remove the pieces as they come up to loading position in front of operator. Spindles are equipped with Weight Feed for holding the grinding members up to work and this allows free micrometer adjustment at all times.

Further details of this interesting Besly Grinding job will be sent on application, and our Engineers are at your service in devising an installation to increase production on your work.



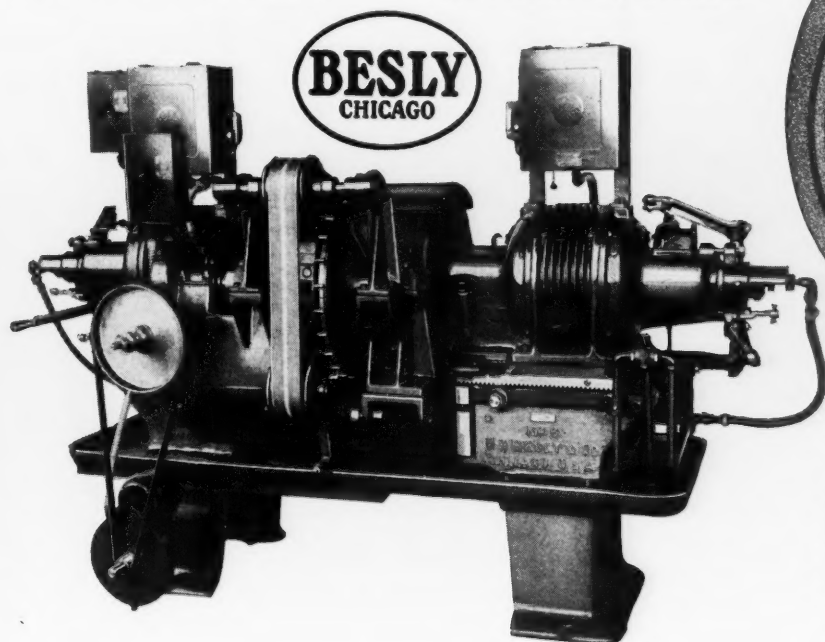
## CHARLES H. BESLY & COMPANY

Originators of Disc Grinders

Works at Beloit, Wis.

120-B No. Clinton St.

Chicago, Ill., U. S. A.



**The Besly-Titan Spiral Abrasive Disc**  
(PATENT APPLIED FOR)

Try this Besly-Titan SPIRAL Disc; you'll find it the ideal disc for the average run of work. It has a very unusual shearing effect that greatly increases the cutting quality; and the clearance grooves prevent friction and excessive heating by enabling the grindings to escape.

This means better work produced at greater speed and with less effort.

Give your disc grinder operator a chance to use this new style disc. Sample sent if you ask for it.





Guide 6" x 72", ground in 8 minutes on 30" x 84" Diamond Face Grinding Machine. Stock removed 1/16".

# In the Railroad Shop—

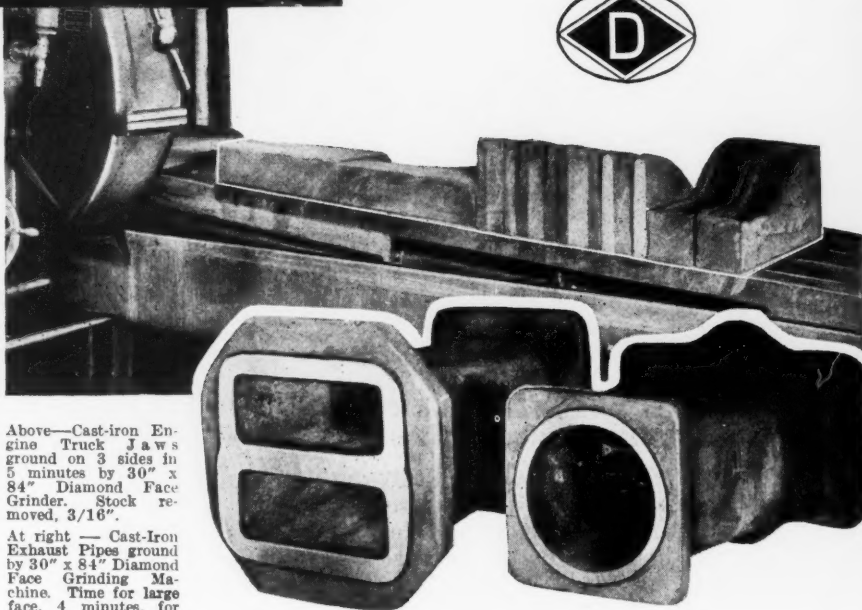
There are Sixty-two Important Jobs that can be Speedily and Economically Handled on Diamond Face Grinding Machines



## 62 Parts Being Successfully Ground on Diamond Face Grinding Machines.

(For details of any of these operations, check those that interest you, clip and send the list to us.)

Switches  
Cross-overs  
Nozzle stands  
Crosshead keys  
By-pass valve plates and covers  
Truck wheel pedestals  
Feed water heater headers  
Wedges  
Side rod straps  
Water scoops  
Goose necks  
Drive brake cylinders  
Tank brake cylinders  
Engine brake cylinders  
Horse shoe liners (brass)  
Engine brake hanger brakera  
Welded air pump cylinders  
Rocker boxes  
Fender boxes  
Tumbling shaft boxes  
Center casting brackets  
Frame cross ties  
Link sheets  
Rub irons  
Collars for trailer bar  
Parallels  
Trailer truck jaws  
Expansion pads  
Eccentric blades  
Chafing irons  
Hand rail column pipe brackets  
Furnace barrier shoes  
Exhaust pipe joints  
Flat joints for feed water heater  
Links (new and built up)  
Main rod straps (built up)  
Slide valves  
False valve seats  
Steam pipe split castings for air-tight casings.  
Joint rim castings for Paxton Mitchell Packing  
Driving-box shoes  
Engine truck pedestal  
Split bushings for reverse shafts  
Split bushings for rocker shafts  
Steam pipe castings for simplified steam chests  
Guides  
Split pulleys  
Crank arms (finished)  
Shear blades  
Steam whistles for locomotives  
Triple valve flange connections  
Driving-box cellars  
Eccentric straps  
Binders  
Main rod brasses  
Steam chest covers  
Valve guides  
Center castings  
Trailer boxes  
Expansion rods  
Guide filling-in plates  
Frogs



Above—Cast-iron Engine Truck Jaws ground on 3 sides in 5 minutes by 30" x 84" Diamond Face Grinder. Stock removed, 3/16".

At right — Cast-Iron Exhaust Pipes ground by 30" x 84" Diamond Face Grinding Machine. Time for large face, 4 minutes, for small face 2 minutes.

Diamond Face Grinding Machines have been established in many leading railroad shops through their ability to increase production on a wide variety of important operations. Increases of 200%, 300% and 500%, with proportionate reductions in costs have been reported.

Shown here are a few typical operations, flat surfaces finished directly from rough castings or forgings, faster and with less waste of material on Diamond Face Grinding Machines than possible by any other method.

Send for Bulletin 627, describing new oil driven type. Or let our experts advise you, without obligation, about any particular work handled in your shop.

## DIAMOND MACHINE COMPANY

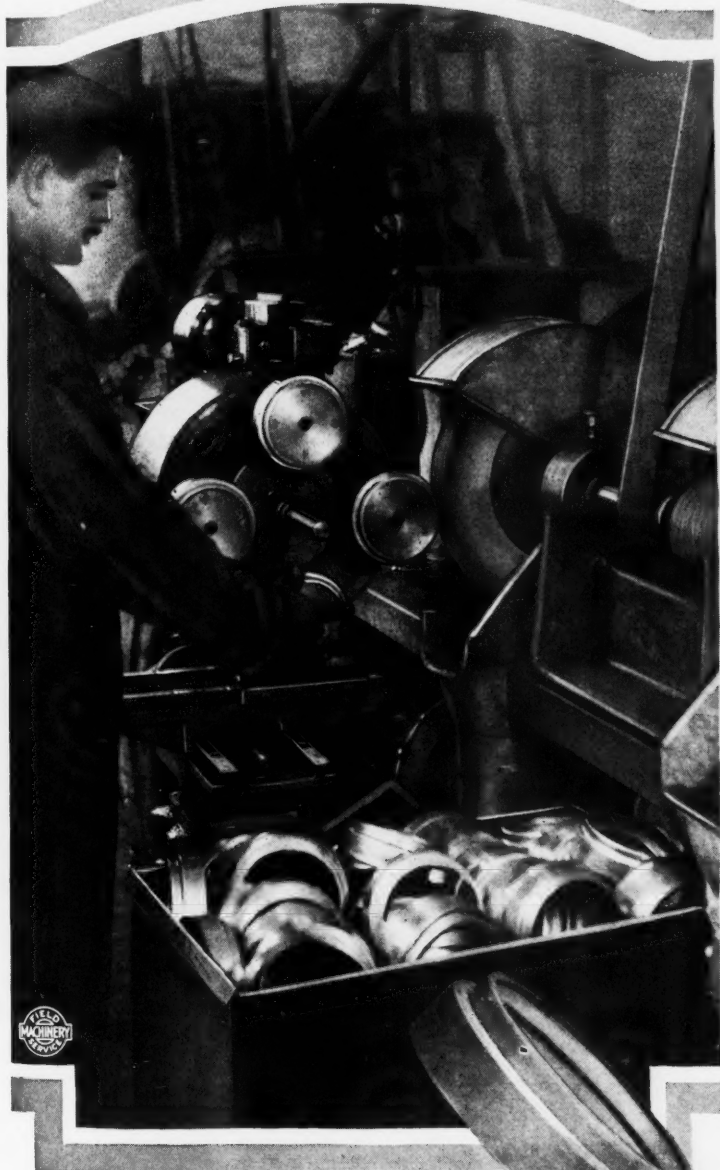
"Grinding Machine Specialists"

9 Coddington Street

Providence, R.I.

# Automatic Buffing

## Puts a Shine on the Morning Rouser

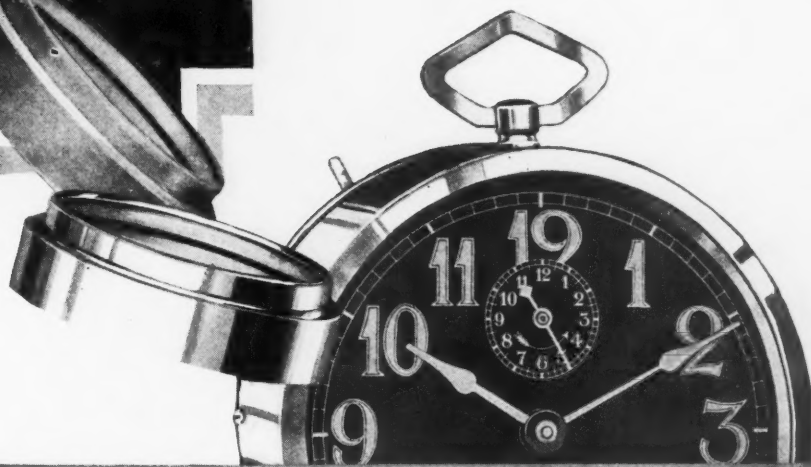


Buffing brass alarm clock cases before plating, doing "satisfactory work, cheaper and faster than hand buffing" the two Automatic Buffing Machines at the E. Ingraham Company, Bristol, Conn., have become important units in the production equipment of this plant.

The parts shown are buffed in two operations, by two operators on two Automatic Buffing Machines and finished at the rate of 250 per hour—production that accounts for the fact that these machines paid for themselves in 45 days of service!

Automatic Buffing has profitably solved metal finishing problems on a variety of large and small, simple and odd shaped parts.

Have you metal parts for buffing or polishing in quantity? Then let's get acquainted.



## Automatic Buffing Machine Company

Chicago and Perry Sts.

:::

Buffalo, N. Y.

# Walker Grinding Machines

Make Good in a Busy  
Canadian Automotive Plant



**T**HESE three Walker Grinding Machines are successfully doing twenty-four-hour duty on automotive parts at the Canadian Acme Screw and Gear Company, Toronto, Ontario.

The demand here is for volume production on high grade work, and the foreman's satisfaction in his recently acquired battery of machines proves that Walker Grinders meet the demand without difficulty.

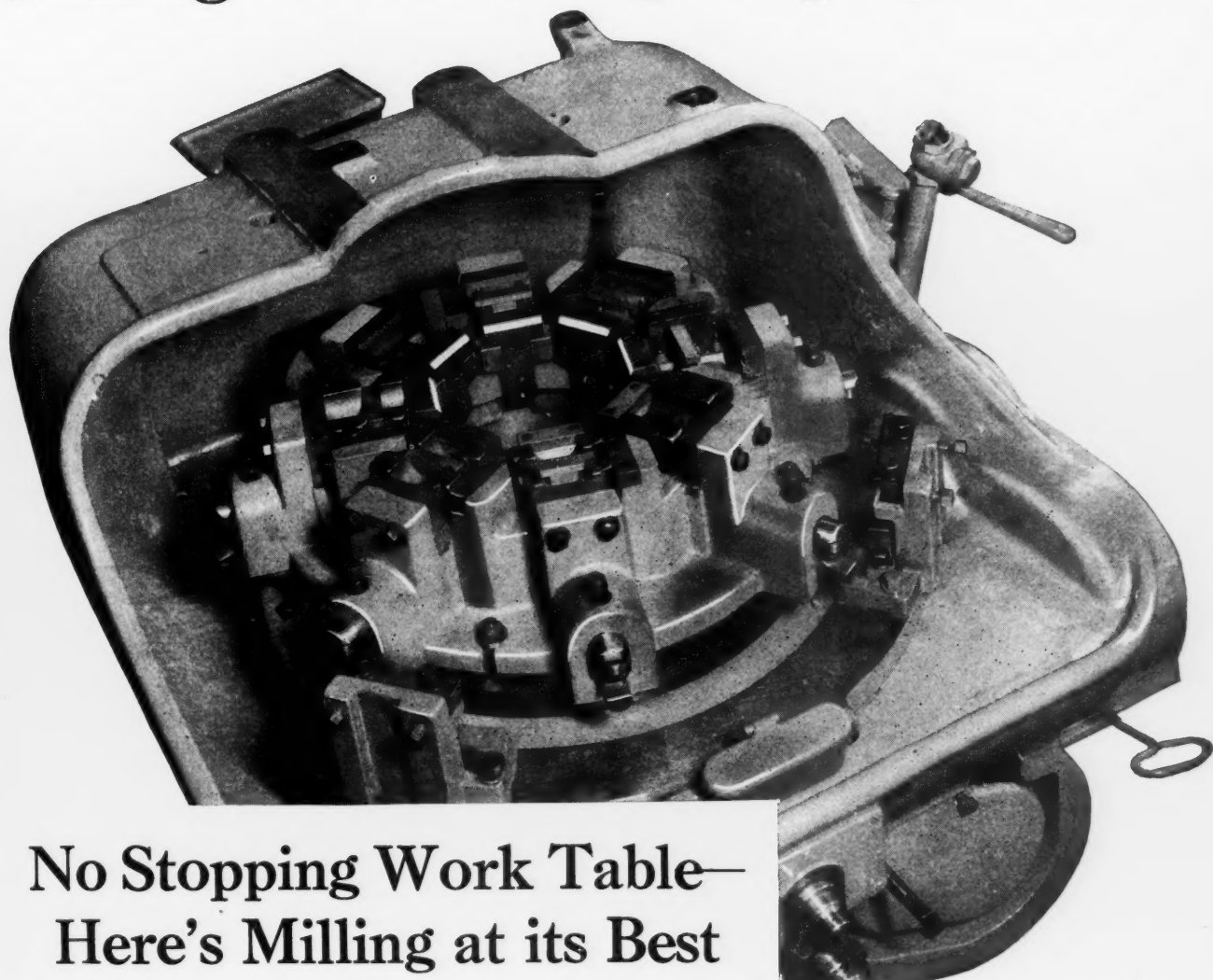
In well known plants, both at home and abroad, Walker Grinding Machines—equipped with Walker Magnetic Chucks—are important assets in profitable production grinding on a wide range of work.

*Send for details of Walker Grinding Machines and Walker Magnetic Chucks  
for holding all classes of light and heavy work.*

**O. S. WALKER CO., Inc., Worcester, Mass.**



# Milling 420 Bearing Caps per hour



## No Stopping Work Table— Here's Milling at its Best

One Oesterlein Tilted Offset Milling Machine, equipped with the fixture shown, produces 420 bearing caps per hour. This is an increase of 118% over the fastest machines formerly on the job, although the old machines represent a greater investment. One milling machine bettering the production formerly obtained by two machines of another type surely is "Milling at its Best."

This automatic clamping device consists of a cam which presses a spring operated plunger into a lock. The spring compression holds the pieces in a locked position until they pass the cutter. The unlocking device first backs up the spring plunger, then unlatches the lock, and the roller following contour of cam allows plunger to release parts slowly, avoiding a slap in the fixture.

### Oesterlein Builds

Ohio Milling  
Machines, Plain  
and Universal.  
Ohio Universal  
and Tool Room  
Grinders.  
The Ohio Tilted  
Rotary Miller.  
Oesterlein Tilted  
Offset Millers.  
Aurora Drills,  
Upright and  
Gang.

*Send us your blue prints or samples—our estimates  
cost nothing and may be of value to you.*

## Oesterlein Tilted Offset Milling Machine

# OESTERLEIN MACHINE CO.

3315 COLERAIN AVE.

CINCINNATI, OHIO



*Better Production  
with Less Effort*

# ANDERSON POWER SCRAPER



The ANDERSON POWER SCRAPER enables one operator actually to finish several times the area he could scrape by hand in a given time with less strain and with better control—getting smoother, more uniform work—than was possible with a hand scraper.

The Anderson Power Scraper operates from the ordinary lighting circuit and has a working range from a fraction of an inch to 4½ feet. Mounted on an elevating truck, it is easily wheeled to the job where it is locked rigid until the operation is completed.

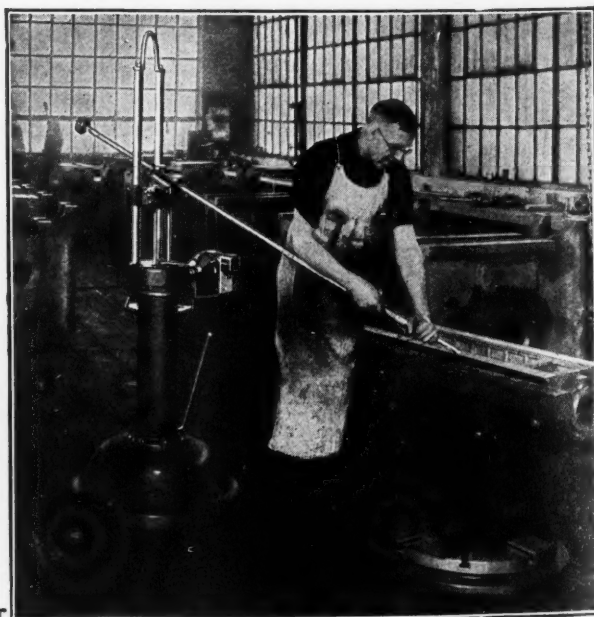
Anderson Spotters, in sets including tools for light and heavy work, reduce costs, improve results on spotting, frosting, flaking, flat finished surfaces. Easily adjusted, efficient and profitable—an economical means for improving the appearance of your product.

*Send for details of the Anderson Power Scrapers and don't forget to ask also about Anderson Spotter.*

Manufactured by

**ANDERSON BROS.  
MFG. CO.**

1910 Kishwaukee St., ROCKFORD, ILL.





# Nine Hours Now!

*Swiss Jig Borers are made in seven sizes, and in styles with from 1 to 3 spindles. Let us tell you more about them.*

## Formerly it took 33 for this job in the Underwood Typewriter Plant

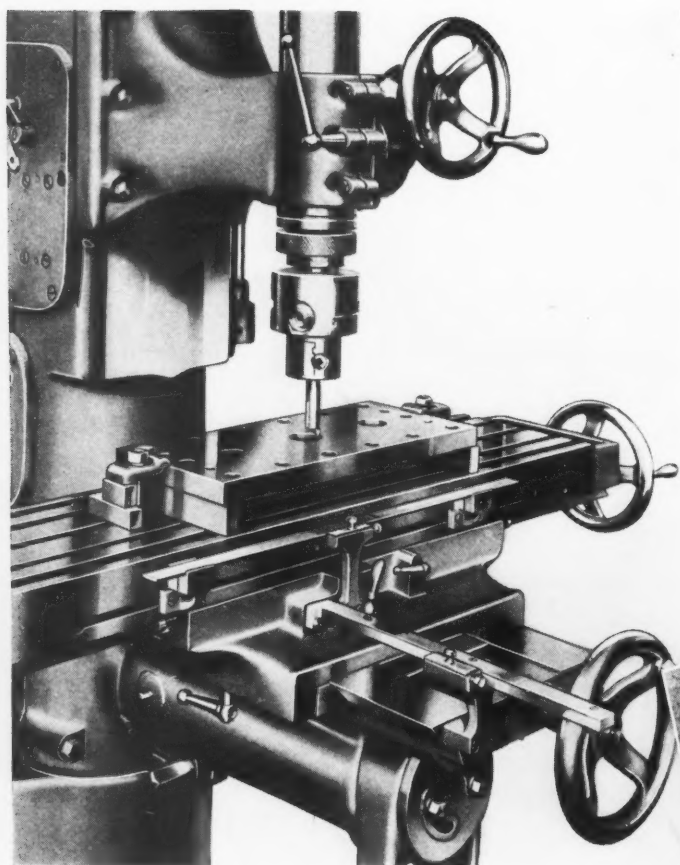
Two years ago the Underwood Typewriter Company, Hartford, Conn., purchased a Swiss Jig Borer to use in making dies, jigs and fixtures. What it has accomplished for them is typified by the job we show here. By the method formerly used it took 33 hours to locate and drill the holes in this part. The Swiss Jig Borer does the work in nine. Hole diameters are held to 0.0005", center distances to 0.001". Small parts in which holes must be drilled with exceptional accuracy are also produced in quantity on the Swiss Jig Borer.

Swiss Jig Borers cut the time required to locate, drill, bore and ream holes to a fraction of that usually consumed. Positioning is done entirely with the screws and micrometer dials—hours of tedious work checking and re-checking with scale and micrometer are eliminated.

**THE R. Y. FERNER CO. INVESTMENT BUILDING Washington, D. C.**  
**SOCIETE GENEVOISE d'INSTRUMENTS de PHYSIQUE**  
 UNITED STATES AND CANADIAN AGENTS  
 Home Office and Works: 8 Rue des Vieux Grenadiers, Geneva, Switzerland.  
 London Office: Societe Genevoise, Ltd., 95 Queen Victoria St., London, E. C. 4.

# SWISS JIG BORERS





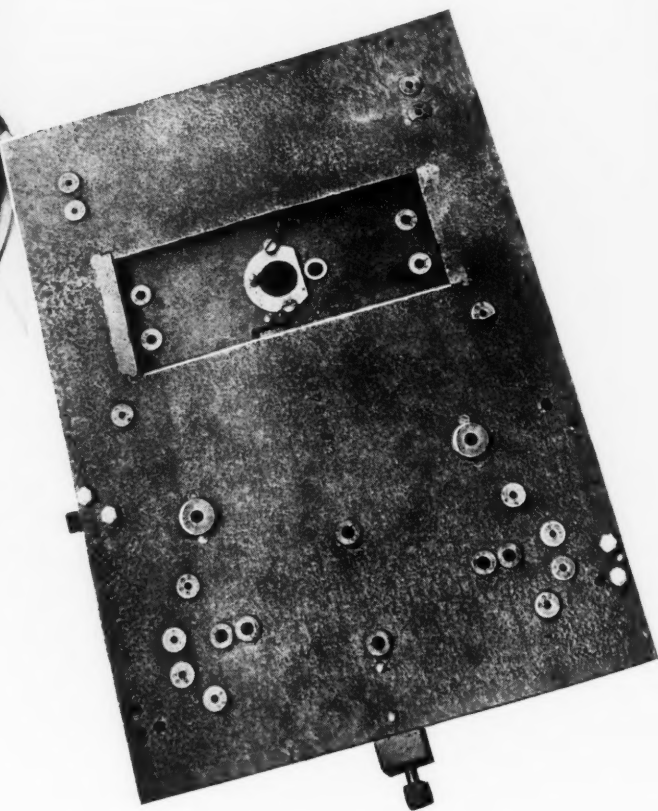
# KNIGHT MILLERS

Bore Jigs  
Accurately

**K**NIGHT Millers are truly universal tool room machines—adapted for milling, for drilling and to handle jig boring operations with maximum efficiency.

For such work the Knight Miller is equipped as above with Scales and Verniers for accurately laying out holes. In the large plate jig at the right, all of the holes were laid out and bored on a No. 3 Knight at the plant of the Haughton Elevator Co., Toledo, Ohio. The job was done both quickly and accurately without the use of buttons or other time consuming methods.

Knight Millers are convenient, efficient and economical, wide range machines that give the kind and grade of service on every application that is usually to be expected only of special purpose equipment.



*Send for details of Knight Millers and their varied applications; ask about the Tilting and Swiveling Table that makes it possible to perform a variety of operations without change of setting.*

## W. B. Knight Machinery Co., St. Louis, Mo.

FOREIGN AGENTS: Great Britain, Coats Machine Tool Co., London; Japan, Yamatake Co., Tokyo.

# Federal Welding

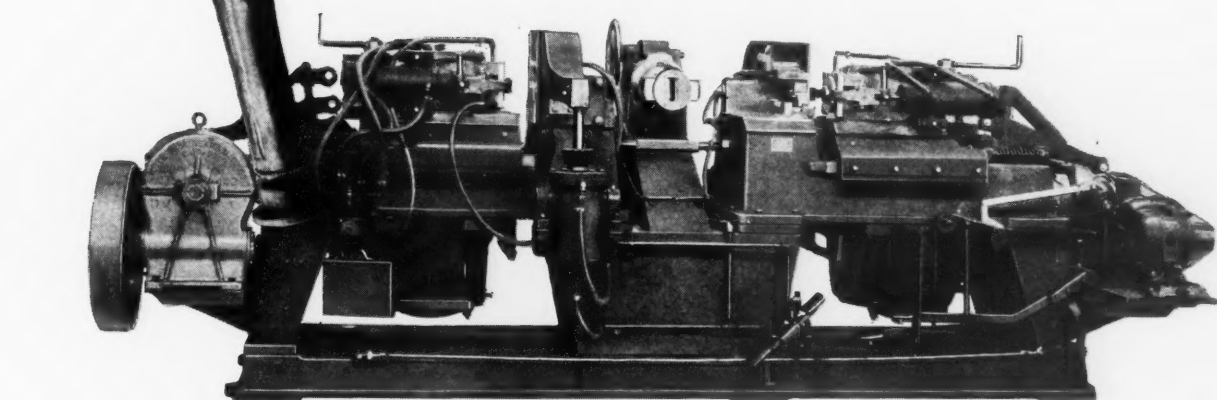
Brake Carrier Flanges to Rear Axle Housings

*Less Than One Cent  
Per Weld for Power  
and Labor Costs*

Good work? Certainly! This specially designed Federal Welder completes this operation on one housing per minute (two welds), and requires only one man and a helper to operate.

Such simplicity, economy and production capacity fit well into the production program of the large automotive plants where this machine is doing its bit to help meet demands that face the entire automotive industry.

Federal Engineers are ready to bring your welding costs down to the irreducible minimum—it's simply a question of *equipment designed for the job* and they have the skill and experience to produce it.



**Federal**

**BUTT  
SPOT  
SEAM**

**Welders**

**FEDERAL MACHINE & WELDER CO.**

Branch Offices

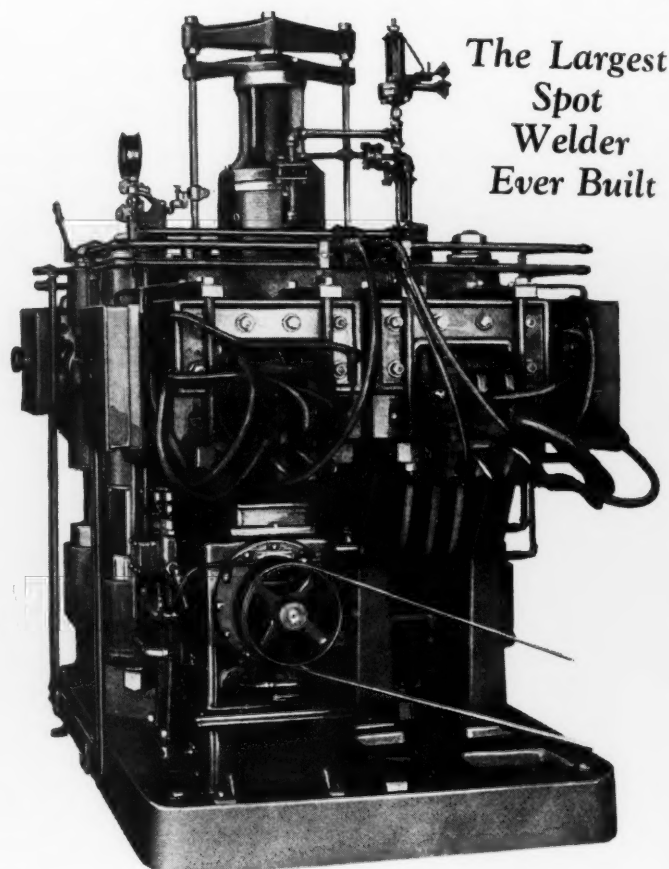
Dana Avenue, Warren, Ohio, U.S.A.

In All Principal Cities

Who  
is better  
Qualified  
to build a  
Special  
Welder

?

Than  
the Builders  
of 300 Types  
and Sizes  
of Standard  
Welders



*The Largest  
Spot  
Welder  
Ever Built*

The above machine is an excellent example of the type of special welders for special purposes, manufactured by Thomson in addition to the regular Thomson line of Butt, Spot and Seam machines. It is rated at 1200 K.V.A. and probably is the largest and most powerful spot welder ever built. In line with the Thomson confidential policy, its use may not be stated.

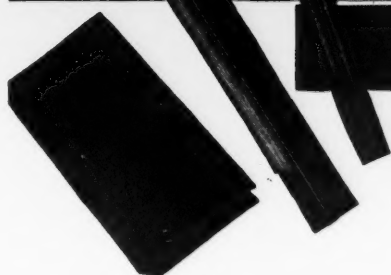
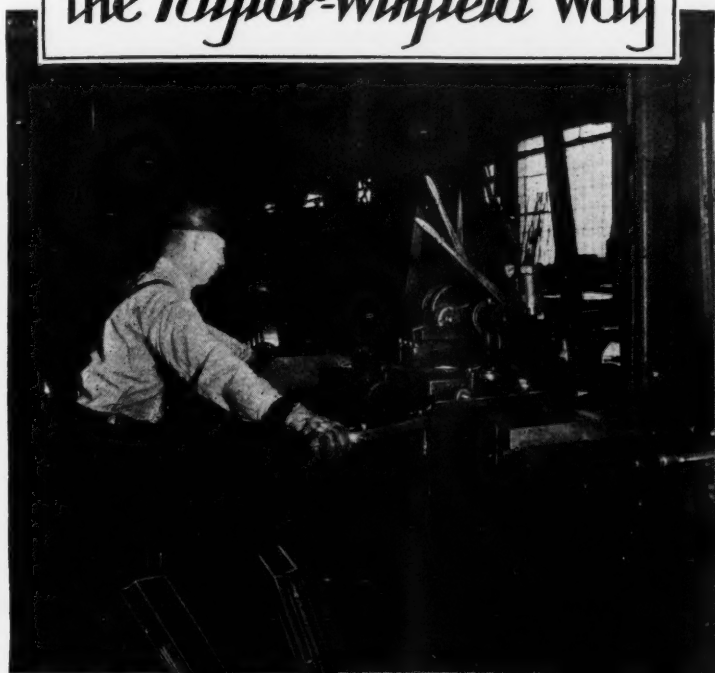
Experience in dealing with innumerable metal fabricating welding problems makes the Thomson organization excellently fitted to answer your welding question. Cooperation from drafting board to actual operation.



Thomson Electric Welding Co.  
LYNN, MASSACHUSETTS,  
U. S. A.



## Producing Metal Desks the *Taylor-Winfield* Way



### Making production profitable

The Jamestown Metal Desk Co. finds Taylor-Winfield welders a big factor in minimizing the cost and increasing their rate of production. Like so many other metal-working concerns, they appreciate that

**T**HE illustrations show a butt-welding and a spot-welding operation in the Jamestown, N. Y., plant of the Jamestown Metal Desk Co., manufacturers of quality metal desks.

## TAYLOR-WINFIELD

Gun-Type, Spot, Butt and Seam

## WELDERS

Write for complete information on the peerless Taylor-Winfield line of electric welders!

are built for enduring, service, economy, accuracy and freedom from trouble. Backed by an organization pioneering in welder design, these welders are offered to industry as the last word in electric welding perfection.

## THE TAYLOR-WINFIELD CORPORATION

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OHIO

PRODUCERS OF ELECTRIC



BUTT, SPOT AND SEAM WELDERS

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Detroit  
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San Fernando Bldg.

# FUZON ARC WELDER

**GAS ENGINE DRIVEN**

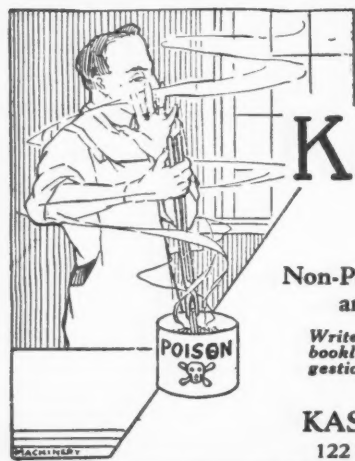


So different in its design and operation that it merits investigation.



**FUSION WELDING CORPORATION**

Welding Equipment and Supply Division of Chicago Steel & Wire Company  
Engineers—Manufacturers—Merchants  
103rd STREET AND TORRENCE AVENUE, CHICAGO



AVOID  
THIS BY USING

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CASE HARDENING  
COMPOUND

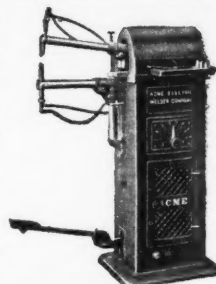
Non-Poisonous, Non-Explosive  
and Non-Inflammable

Write for FREE sample can, also  
booklet "M"—valuable for its sug-  
gestions, recommendations, tables,  
etc. Ask your dealer.

**KASENIT COMPANY**  
122 Greenwich St., New York

## ACME SPOT WELDER

Recognized by leading manufac-  
turers as the highest type of pro-  
duction welder. Built to perform  
24 hours a day year in and year  
out. The patented swivel lower  
horn reduces set-up time to the  
very minimum, increasing pro-  
duction and lowering manufac-  
turing costs.



Built in Nine Sizes  
Lowest in Price—Highest in Efficiency  
Write for Further Particulars

**ACME ELECTRIC WELDER COMPANY**

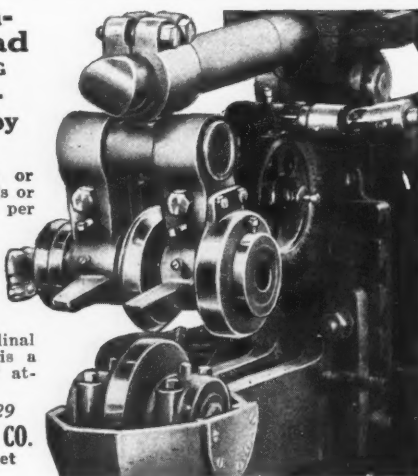
PHILADELPHIA, Bourse Bldg. CHICAGO, 817 Washington Blvd.  
DETROIT, Blvd. Temple Bldg. LOS ANGELES, 5617 Pacific Blvd.

## Lewis Seam- Welding Head

PATENTS PENDING  
Fits Any Spot-  
Welder Proven by  
3 Years' Use

Will weld side seams or  
bottoms of buckets, pails or  
tanks at 15 to 25 ft. per  
minute and make joint  
water and gas tight.  
No change to your spot  
welder—simply clamp  
Head to upper horn.  
Bolt on the proper  
electrode for either  
transverse or longitudinal  
welding. The "drive" is a  
separate unit and NOT at-  
tached to spot welder.

Send at once for Bulletin 129  
**WELDING APPLIANCE CO.**  
2111 West Lake Street  
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## Imperial

OXY-ACETYLENE

**Welding and Cutting Equipment**

An Outfit for Every Shop and Every Purpose

**THE IMPERIAL BRASS MFG. CO., 531 So. Racine Ave., Chicago**

## "HEAT-EASY" Compound

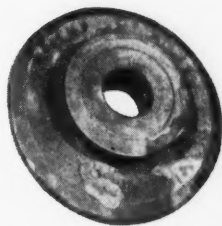
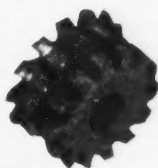
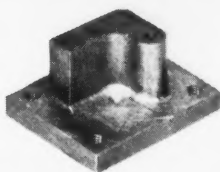
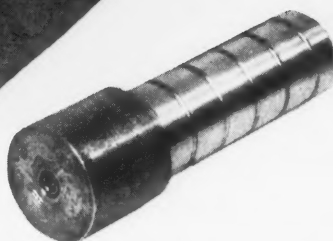
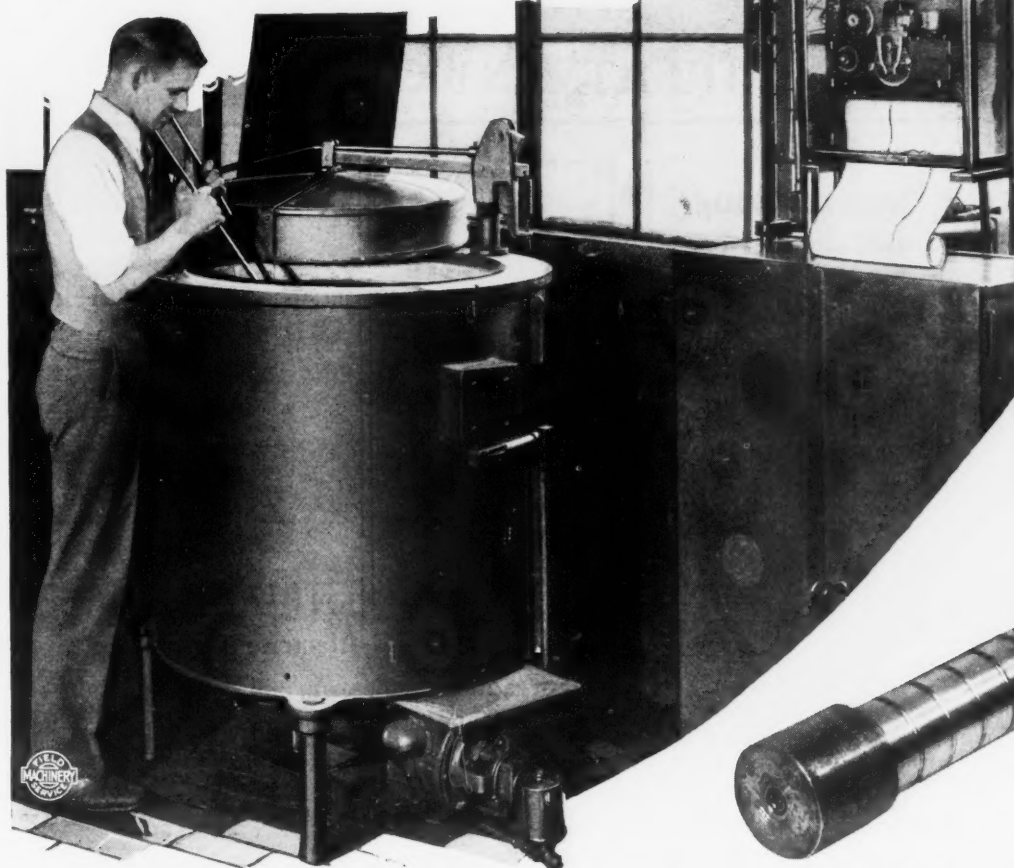
Prevents Scaling and Distortion in Hardening  
**HIGH SPEED STEEL**

Also, We do Skilled Hardening and Heat-Treating of  
every kind, and guarantee the results

**THE BENNETT METAL TREATING COMPANY, Elmwood, Conn.**

# HOMO

*Cuts Tempering Costs  
in Half*



And the 50% reduction in actual tempering costs is only one point of satisfaction provided by the Homo tempering furnace installation at the Wheeling Corrugating Co., Wheeling, West Virginia. Uniformity—the ability to duplicate conditions and results for one batch of work after another, cleaner work and greater operating convenience—all these things count, and Homo users are not slow to appreciate them.

Simplicity is the keynote of Homo Tempering—uniformity and production economy the result. Details are readily explained and easily understood—if you temper parts in *any* quantity send for catalog 93-Y.

F-100



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## WE DO COMMERCIAL HEAT-TREATING

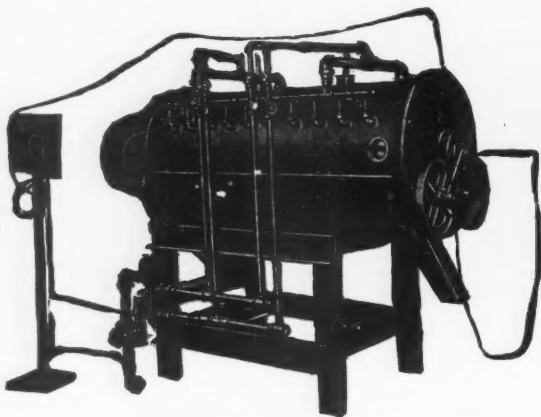
including—

CASE-HARDENING  
HARDENING  
ANNEALING  
TEMPERING  
GUN METAL  
COLORING, ETC.



**AMERICAN METAL TREATMENT CO.** Spring and Lafayette Streets,  
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### For Automatically Heat Treating Bolts, Nuts, Washers, etc.



No. 136 Heating Machine with Automatic Heat Controller capacity for hardening or annealing 200 pounds per hour.

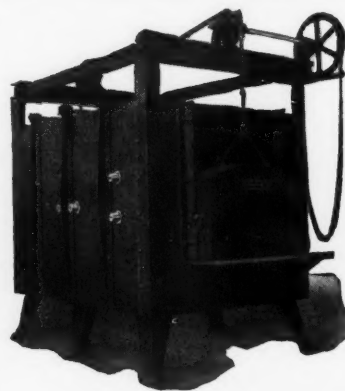
Capacity of No. 139 Heating Machine (same style as No. 136 but larger) 1000 pounds per hour.



Uniform heat treatment at low cost per pound. Write for complete information.

**AMERICAN GAS FURNACE CO.**

Elizabeth New Jersey



S. C. & H.  
Electric  
Oven  
Furnace

### S.C. & H. INDUSTRIAL FURNACES

Oil—Electric—Gas

For annealing, carburizing, forging, hardening, oil tempering, plate heating, spring heating, melting soft metals, etc.

The illustration shows an S. C. & H. Electric Oven Furnace for annealing, case hardening and heating.

Write for detailed information.

**THE STRONG, CARLISLE & HAMMOND CO.**

Manufacturers

1392 West Third St.

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—Furnace Room Accessories—  
Everything for heat treating

### KRUPP Mikrotast GAUGES

for Test Bench and Workshop

Based on entirely new principles. With the 39° saddle, the axial movement of the work contact rod equals the diameter variation.

The three point contact with the work, as compared with the usual two, is more effective for showing deviation from true circular form.

12 saddles of 39° and 90° angle cover the range from 1/4 in. - 40 in. for external cylindrical checking.

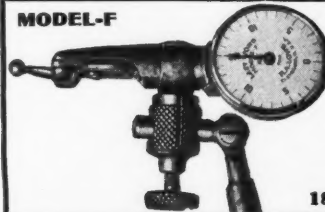
Various designs for internal and external work, threads, tapers, gears, taps, etc. Ask for catalog.

**COATS MACHINE TOOL COMPANY, Inc.**

112 West 40th St., New York



MODEL-F



**"LAST WORD"**  
UNIVERSAL  
Test Indicators

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Comtorgage, O  
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Comtorblocks  
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for production and inspection measurement of outside and inside machine diameters.  
**THE COMTOR COMPANY, Waltham, Mass.**

# BRISTOL'S EQUIPMENT



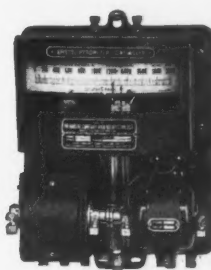
This Booklet describes them in detail—  
may we send you a copy?

## Dependable Temperature Control

The successful production of the remarkable steels of today is made possible only by utmost accuracy and uniformity in the control of heat treating temperature conditions. And in a surprising number of plants famous for their steel products Bristol's Equipment is carrying the burden of keeping temperatures right.

Bristol's Equipment includes Automatic Pyrometer Controllers, Motor and Solenoid Operated Valves for oil, gas and air—Fire Ends, Recording Instruments of all kinds—all rugged, dependable and remarkably precise.

Bristol's  
Model 479  
Controller

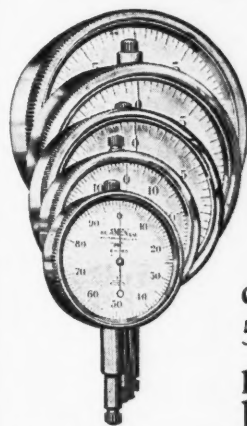


### Important Features

1. 7-Inch Scale, longest used at present time in any thermo-electric control.
2. Point of control is easily adjustable from outside bottom of case.
3. Safety adjusting mechanism.
4. "Weston" High Resistance Milli-Volt-meter movement, specially designed for control apparatus.
5. Automatic cold-end compensation.
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7. All parts are easily accessible and interchangeable.
8. All bearings are provided with efficient oilers.
9. Motors available for all standard voltages and frequencies.
10. Dust-tight case.

The Bristol Company Waterbury, Connecticut  
FOR 35 YEARS MAKERS OF  
BRISTOL'S RECORDING INSTRUMENTS

## — AMES — Dial Gauges Stand Up!



A RECORD for durability unsurpassed — more than 22,000,000 blows on the spindle of an AMES No. 55 at the rate of four per second with no breakage of parts and with accuracy unimpaired—and in good shape when the test was completed.

**B. C. Ames Company**  
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## IS the ROCKWELL Hardness Tester accurate?

### The Answer—

“We find these instruments to be invaluable for the accurate determination of tempers of finished tools, both High Speed and Carbon, and know of no instrument that brings this more nearly within an exact science than the Rockwell machine.”

“MORSE TWIST DRILL & MACHINE CO.”  
“W. T. Read, Vice-Pres. and Treas.”

**WILSON-MAEULEN CO.**  
INCORPORATED

382 Concord Avenue, New York

# LEITZ

Contour  
Projector  
and  
Controlling  
Apparatus  
for  
Testing Technical  
Profiles and  
Precision Fittings



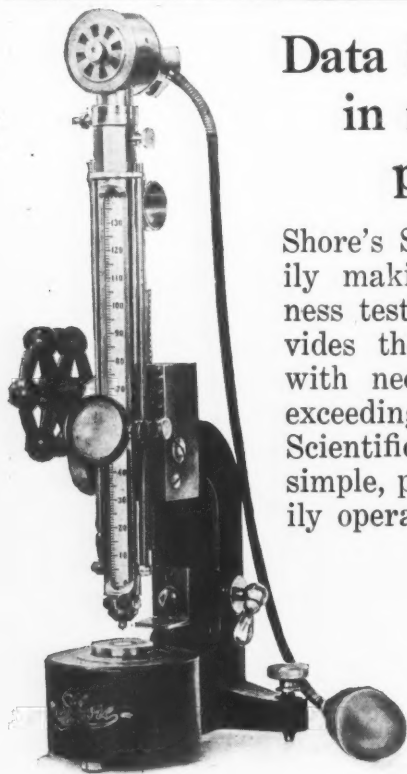
## Its Purpose and Features

1. Precision Control of gears, hobs, taps, die-heads, screws, threads, etc.
2. Measuring of screw-thread angles;
3. Measuring the pitch of screw-threads;
4. Testing the accuracy of small and diminutive elements of mechanisms to the highest grade of precision;
5. Under magnifications of 10X to 100X the outline of tool-parts, gears, screw-fittings, etc., is projected affording a very accurate method of checking the slightest deviation from the required standard;
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8. Checking the quality of work during and after manufacture;
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10. This method saves much time and material and prevents fatigue to the eyes, resulting in greater reliance on the tests;
11. Perfectly undistorted magnified tracings are made as means of critically checking outlines due to all ratios being reproduced with mathematical precision;
12. By means of a photo-attachment photographic reproductions are made to serve the same purpose as outlined under point 11.
13. **SIMPLICITY IN DESIGN IS A SAFEGUARD OF EASY MANIPULATION—NO SPECIAL TRAINING BEING REQUIRED.**
14. **SUMMARY: THIS APPARATUS IS INDISPENSABLE FOR MASS-PRODUCTION WHEN INDIVIDUAL UNITS REQUIRE A HIGH STANDARD OF PRECISION.**

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Data invaluable  
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Shore's Scleroscope, easily making 1000 hardness tests per hour provides the manufacturer with necessary data at exceedingly low cost. Scientifically accurate, simple, portable and easily operated.

Send for Bulletin No. 22 on the Shore's Scleroscope, the Pyroscope and the Shore Method of Selective Carburizing and Hardening.

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Agent for British Empire, Coats Machine Tool Company, Ltd., 14 Palmer St., Westminster, London, S. W. Yamatake & Co., Tokyo, Japan. Au. Forges de Vulcaïn, Paris, France. R. S. Stokvis & Zonen, Ltd., Belgium and Holland.

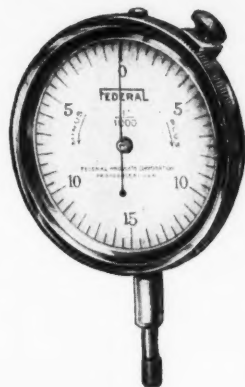
# FEDERAL DIAL INDICATORS

The exclusive features of Federal Dial Indicators afford an accuracy, reliability and freedom from the usual dial indicator troubles which considerably reduce inspection expense, and increase production.

Available in many styles and in special gaging devices. Catalog sent promptly on request.

## FEATURES:

1. Jewelled bearings.
2. Unit movement with top and bottom plate—Independent of case.
3. Racks chromium plated to prevent sticking.
4. Stem is cast integral with case—cannot work loose.
5. Solid bronze alloy die cast case.
6. Compound movement using 40 tooth rack gear.
7. Stainless steel bushing in stem gives long wear and is easily replaced when worn.



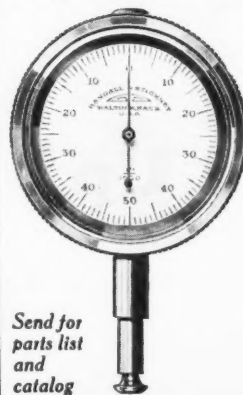
**FEDERAL** Products Corp.

Providence, Rhode Island

Western Branch: 7338 Woodward Ave., Detroit, Mich.

## PRECISION DIAL INDICATORS

Made for Accurate  
Production Gaging

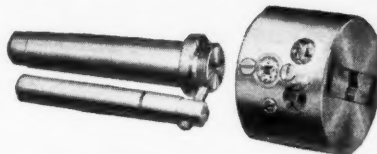


Send for parts list and catalog

Precision Dial Indicators are made for the rapid gaging of parts at the machine on a production basis. Finely made of carefully selected materials, rugged and reinforced at wear points, they give satisfactory service and seldom require adjustments or repairs. Handy bracket on back is provided for ready attachment to machine frame. Dial is graduated with 50 divisions each way from zero, each equivalent to 0.001".

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248 Ash St., Waltham, Mass., U.S.A.

## For Economy in Precision Boring



**Flynn  
Micrometer  
Off-Set  
Boring Heads**

A mechanically-perfect precision head of simple design and few parts.

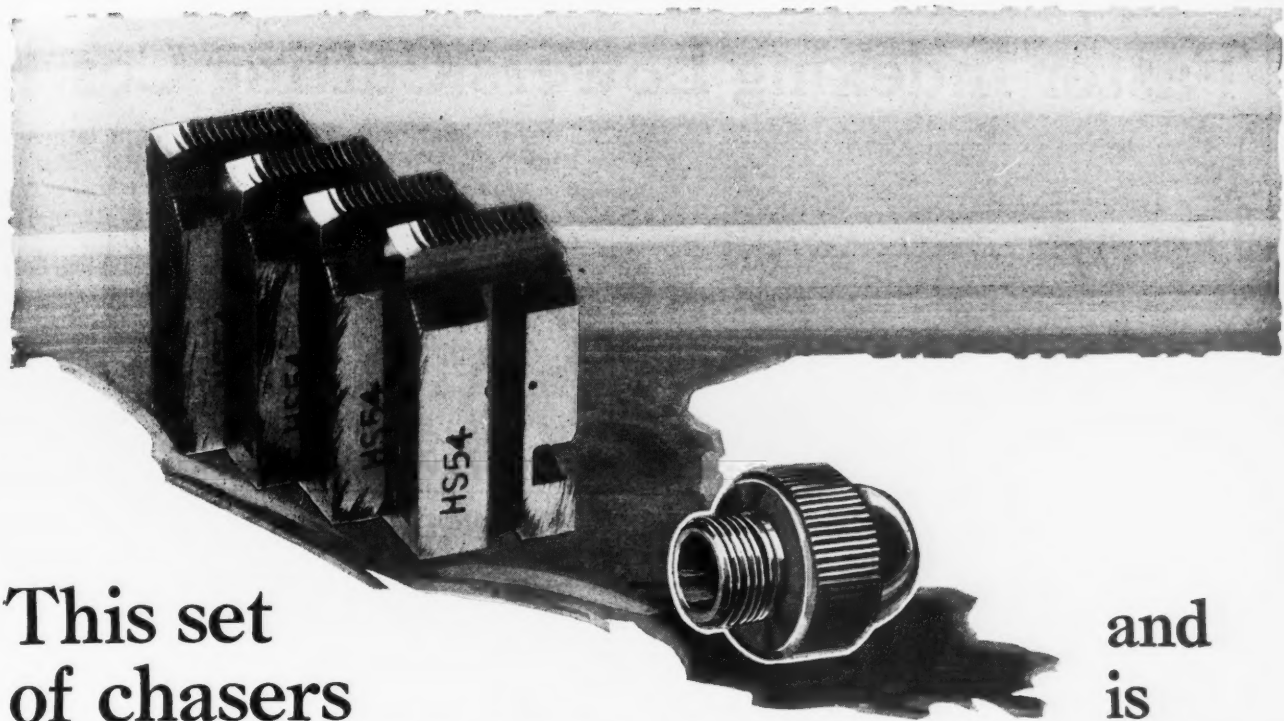
All parts of heat-treated nickel steel.

This compact head has the least overhang of any head on the market, yielding utmost rigidity, and maximum table travel.

Made in a full range of sizes to fit all standard spindles and arbors. Send for descriptive bulletin and price list.

**J. M. WATERSTON** 423 Woodward Ave.  
DETROIT, MICH.





**This set  
of chasers  
threaded 400,000 of these**

**and  
is  
still  
on the  
job**

Below, we show a Geometric Style DS Die Head mounted on a Brown & Sharpe Automatic in the plant of the Martin Copeland Co. threading Shaft Nuts for Sarco Vernier Shaft Dials.

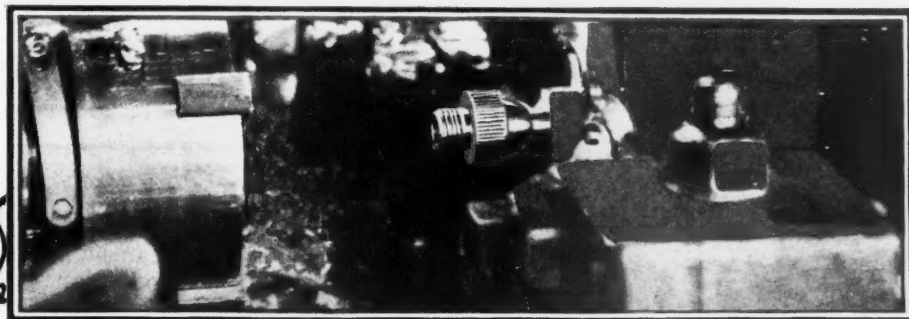
Threads are  $\frac{3}{8}$ -in. diameter, 32 pitch,  $\frac{1}{4}$ -in. long.

Production averages 4800 per day. Production before the adoption of "Geometrics" was 2700 Nuts per day.

The outstanding feature of Geometric Die Heads is Chaser life. The set of Chasers, shown at top, threaded over 400,000 of the Shaft Nuts without a grind, and is still good for many more.

Cost cutting, minimum inspection and long life follow "Geometric" standardization.

## GEOMETRIC DIE HEADS

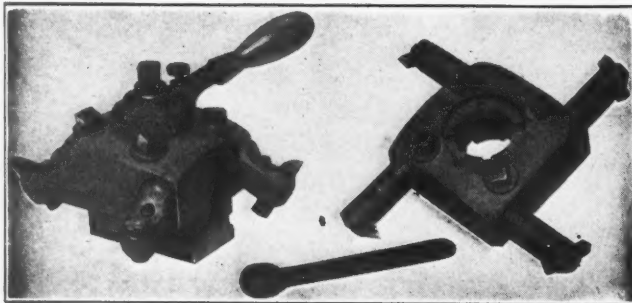


**The Geometric Tool Company**  
(Westville Sta.) New Haven, Connecticut, U.S.A.



Also manufacturers, for more than 30 years, of the well-known Geometric Line of Collapsing Taps and Threading Machines. If it can be threaded, Geometric has the tool to do it.

## Faster Indexing Lowers Cutting Costs

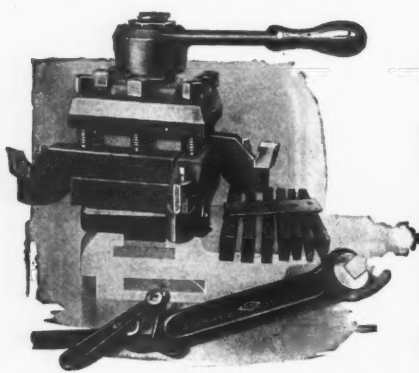


Four tools are always ready on engine lathes equipped with Lovejoy Turret Posts. Tool changes are eliminated, the work speeded up, and costs greatly reduced on a wide range of several operation jobs. Extra rings are provided, tools are easy to set, and always rigid and accurate on the heaviest cuts.

*Write for catalog describing the complete line of cost-cutting tools.*

**The Lovejoy Tool Co., Inc.**  
Springfield Vermont

METAL CUTTING TOOLS



### A Tool Post for Any Engine Lathe

The OK Four Way Tool Post is designed to be used with any engine lathe of 14" swing or over, and is arranged to bring the distance from tool seat to lathe center the same for all sizes of lathes.

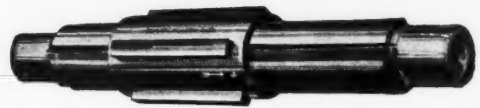
Important special features promote rapid and accurate indexing, save the operator's time and increase output.

The efficient and economical OK System of tool holders for external and internal work is especially adapted for use in the OK Tool Post. Our Catalog describes both—let us send you a copy.

*"Our Service Department is at your Command."*

THE  TOOL CO., INC.  
Shelton, Conn.

**OK.** Tools for  
LATHES, SHAPERS,  
PLANERS, BORING  
MILLS, AUTOMATICS,  
SPECIAL MACHINES,  
MILLING MACHINES



Nicholson Expanding Mandrels *halve* the time it takes to set up for work between 1/2" to 7" diameter. Useful always, they're invaluable on emergency work. Ask about them.

**W. H. NICHOLSON & COMPANY**  
112 Oregon Street, WILKES-BARRE, PA.

### MURCHEY THREADING TOOLS

Forty-two sizes of Self-Opening Die Heads, Fifty-nine sizes of Collapsible Taps—production tools that increase profits on important work.

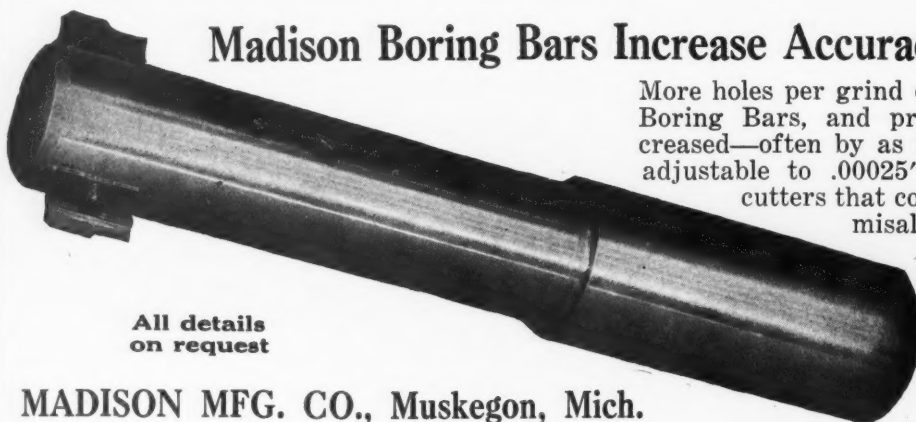
**MURCHEY MACHINE & TOOL COMPANY**  
34 Porter Street, Detroit, Michigan



### SPECIAL

and Standard, Milling Cutters, Saws, Gear Cutters, Rotary Knives, Solid Type Reamers and Special Tools. ©

**COWLES TOOL COMPANY, Cleveland, Ohio**  
TOOL MANUFACTURERS



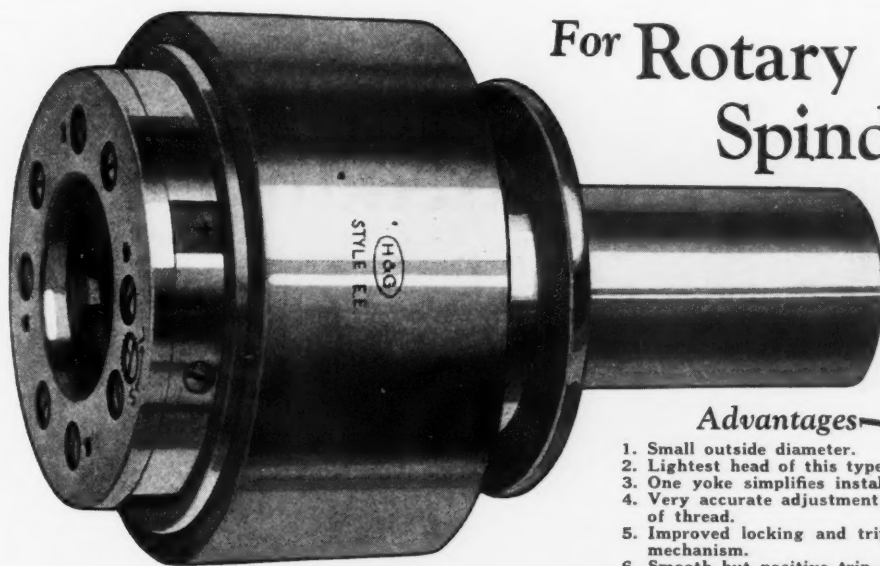
### Madison Boring Bars Increase Accuracy and Production

More holes per grind can be bored with Madison Boring Bars, and production is invariably increased—often by as much as 400%. They are adjustable to .00025" and incorporate floating cutters that compensate for any possible misalignment in automatic and turret lathes.

All details  
on request

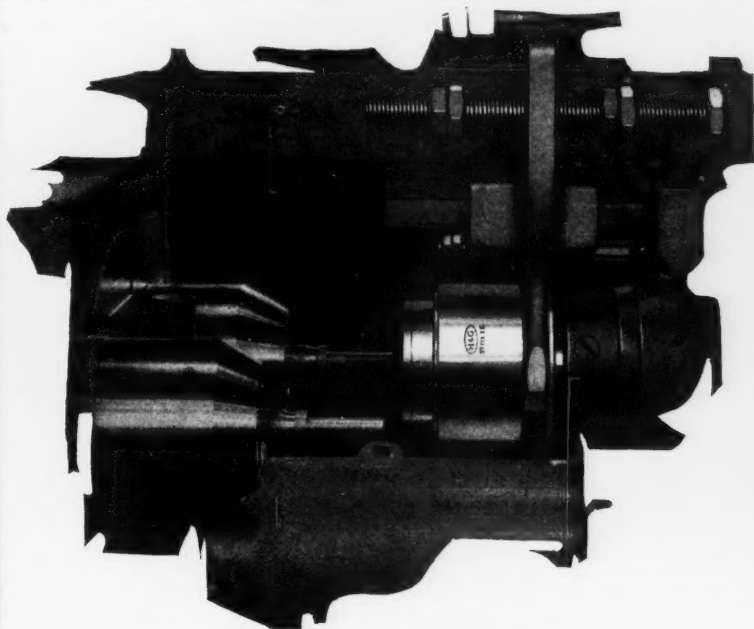
**MADISON MFG. CO., Muskegon, Mich.**

## For Rotary Spindles

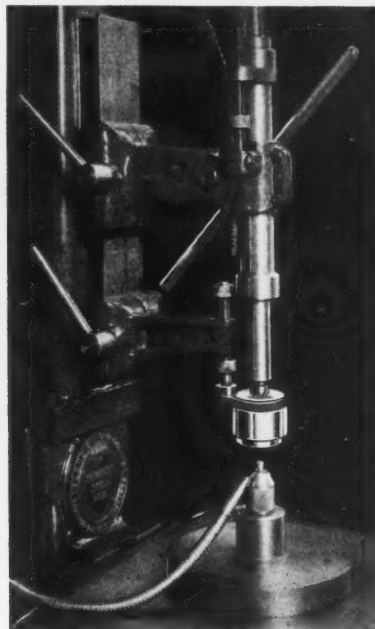


### Advantages—

1. Small outside diameter.
2. Lightest head of this type.
3. One yoke simplifies installation.
4. Very accurate adjustment for length of thread.
5. Improved locking and tripping mechanism.
6. Smooth but positive trip.
7. Outer sleeve is hardened.



*Style EE with Yoke on Gridley Automatic Screw Machine*



*Style EE installed on Drill Press*

## H & G Die Head—Style EE

IMPROVED TYPE FOR ROTARY SPINDLES

This New Die Head, known as Style EE, is opened and closed by one yoke which fits a spool or groove in the outer sleeve of the head.

Style EE Heads are designed for use on automatics such as Gridley, Acme, Cleveland (Multiple), New Britain, Cone, Greenlee, Davenport, etc., and also for use on chucking machines, bolt threaders and drill presses.

The small outside diameter provides ample clearance on machines and eliminates any possibility of blanks from chips on machines having small clearance between die spindle and slide.

Write for new booklet "18 Vital Points to Consider when Selecting a Die Head," and Style EE Folder.

**THE EASTERN MACHINE SCREW CORPORATION, New Haven, Conn.**

All Styles of H & G  
Die Heads use  
the same chasers



Sizes and Styles for  
all machines on  
which threads are cut

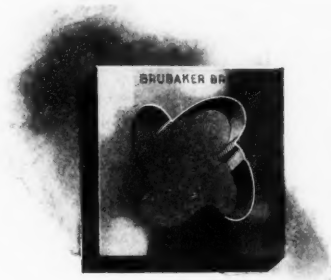


# The Right Prescription for Threading Ailments

Brubaker Round and Square Pipe Dies cut the threads that make tight connections. They have ample chip clearance, thus cut clean and fast.

A set of Brubaker Pipe Dies last long—even in the hands of the shop maintenance gang.

That's because we put the best of our years of experience into their making.



Send for details and price lists of Brubaker Tools

**W. L. BRUBAKER & BROS. CO.**

FACTORY: MILLERSBURG, PA.

SALES OFFICE: 50 CHURCH ST., NEW YORK, N. Y.

SPIRAL FLUTED  
STAYBOLT TAPS  
REAMERS  
TAPS  
DIES  
END MILLS  
STRAIGHT AND TAPER  
INSERTED BLADE REAMERS

*Ready  
Now*

New Catalog  
No. 32

for distribution

Card Catalog No. 32  
will prove a standard  
source of reference. Be  
sure to send for a copy.



It lists and describes the complete Card Quality Line of taps, dies and screw plates regularly stocked for immediate shipment. It also contains valuable tables of information relative to tap dimensions, screw thread standards and thread tolerances of vital interest to Engineering Departments, Production Executives and Purchasing Agents.

**S.W. CARD MFG. CO.**

DIVISION OF UNION TWIST DRILL CO.

MANSFIELD, MASSACHUSETTS, U.S.A.

# Davis

## The Improved Davis "Type L" Micrometer Expansion Boring Tools

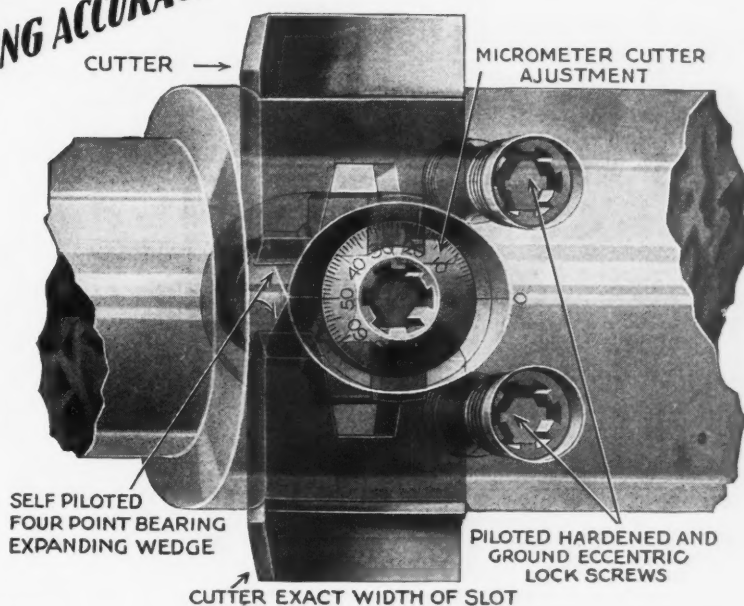
**STRONGEST TOOLS! POSITIVE BORING ACCURACY! FASTER BORING TIME!**

The cost of boring operations will be reduced and production increased by equipping all of your boring machines with Improved Davis "Type L" Expansion Boring Tools.

The quick micrometer adjustment for expanding the cutters to bore any size required or to compensate for wear, will enable you to bore odd sizes and maintain absolute accuracy of standard sizes.

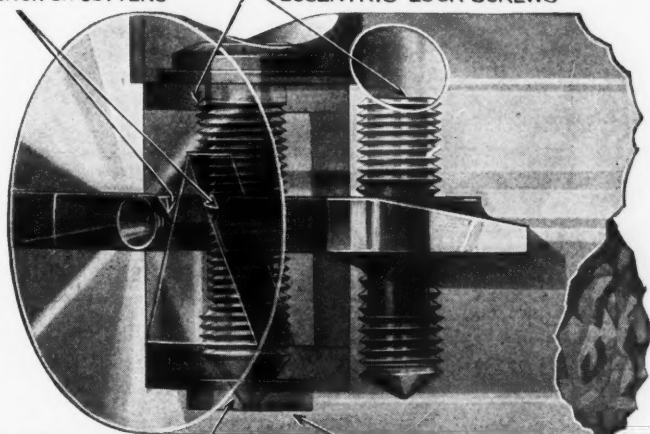
Definite production is guaranteed with the use of Davis "Type L" Expansion Boring Tools which can be furnished to suit any style of boring machine.

Write us today regarding your boring operations.



EXPANDING WEDGE ACTION ON CUTTERS

HARDENED AND GROUND PILOTTED ECCENTRIC LOCK SCREWS



MICROMETER ADJUSTMENT SCREW PILOT BEARING

NOTE-HOLE IS NOT THROUGH THE TOOL BODY

### COMPLETE UNITS OF EXPANSION BORING TOOLS AND REAMERS

- 1—Davis Micrometer Expansion Boring Tools, for rigid boring.
- 2—Davis Block Type Expansion Boring Tools for rigid boring and float reaming.
- 3—Davis Expansion Multiple Cutter Boring Heads.
- 4—Special tools furnished in any design for any machine that bores.



Replacement Cutters

Carried in stock for immediate delivery furnished with a guarantee to bore more holes per grind than any other cutter.

## Davis Boring Tool Company

Incorporated  
DIVISION

### LARKIN PACKER CO.

6200 Maple Avenue

St. Louis, Mo.

QUALITY HAS NO SUBSTITUTE

## Count your drill mileage—

Ever count the distance your drill goes without resharpener? It's an interesting—and sometimes revealing—study.

One Colton-Detroit record is for 187,000 holes  $\frac{5}{8}$ " diameter and 1" deep—a distance of 3 miles—drilled *without* resharpener.

Count drill mileage on some particular job—try out a Colton-Detroit High Speed Drill on the same work and compare results.

Send for catalog and price list

### ARTHUR COLTON COMPANY

2618 Jefferson Avenue, E., DETROIT, MICH.

REPRESENTATIVES: New York City: F. A. Brady, Inc., 30 Church St. Milwaukee: General Sales Agency, 3205 Vine St. Pittsburgh: A. E. Coburn, 1105 May Bldg. Philadelphia: Wenson Tool Co., 745 North Sixty-third St. San Francisco: L. G. Henes, 75 Fremont St. Los Angeles: L. G. Henes, 1418 Santa Fe Ave. Cincinnati: Advance Tool Co., Canal and Jackson Sts. Syracuse: Wm. G. Harvey, 420 First Trust & Deposit Bldg. Atlanta, Ga.: J. R. Walraven, 205 Forsyth Bldg.



Colton-  
Detroit  
High-Speed  
Drills

## What's Wrong With This Picture?

This ragged excuse was once as fine a drill as was ever hot twisted from a piece of tough steel, but improper repointing ruined it. Too high a heel is the particular trouble here—a drill lacking clearance back of the cutting edge will drag and eventually break.

"How to Point Celfor Drills" is the title of a large photographic wall chart prepared by the Clark Equipment Company. It pictures in detail the correct methods of drill pointing. You can have one of these charts FREE—merely write for it.

**CLARK EQUIPMENT COMPANY**  
1199 Days Ave., BUCHANAN, MICHIGAN



GAMMONS HELICAL END MILL

### For Speed and Finish

Fast cutting ends and smooth cutting bodies enable Gammons-Holman Helical Chucking Reamers and End Mills to get results that set service standards in plants where these tools are used. Send for details—get estimates on Gammons-Holman production tools.



GAMMONS HELICAL CHUCKING REAMER

**THE GAMMONS-HOLMAN CO.**  
Dept. M. MANCHESTER, CONN.

### "Red Shield" High Speed Drills



ALL SIZES

**THE STANDARD TOOL CO.**

NEW YORK

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REGISTERED  
TRADE-MARK



### TAPS and DIES

The Famous "Carpenter Quality"

Precise Uniform Durable

**J. M. Carpenter Tap and Die Company**

Oldest Tap and Die Makers in America

Pawtucket

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## In the Building of Aircraft



### R & N CORRECT SPIRAL EXPANSION REAMERS

Just as the design and construction of gasoline engines have advanced to keep step with the rapidly growing airplane industry, so too the tools that build them have been improved. And in the reamer line, R & N products have been developed to an unparalleled degree of efficiency.

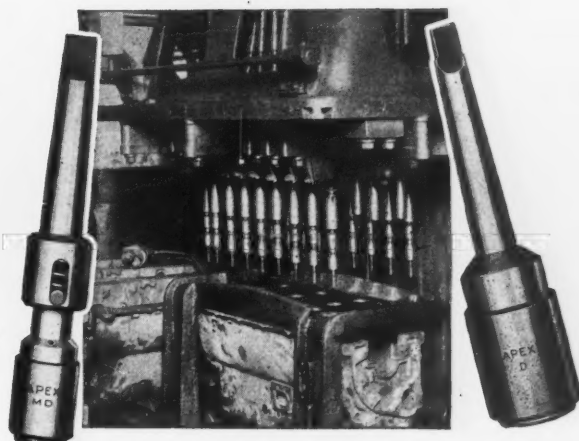
Standard in leading automotive plants, they incorporate a wealth of features that bring to aviation motors the precision demanded—along with an equally welcome economy. Built from steel that will not break under expansion, they take a maximum number of re-grinds, which, because of the inserted expansion screw, permits grinding under slight expansion. A floating pilot, tapered on its outside diameter, is adjustable to fit any hole within range, assuring positive alignment in fitting oversize and standard pins.

*For full details of R & N  
Correct Spiral Expansion Reamers,  
write us for circulars.*

**Reiff & Nestor Co.**

Manufacturers of Taps  
and Reamers

Lykens, Penna., U. S. A.



Multiple  
Tapping

Tapping Crank Cases  
Marmon Motor Car Co.  
Using Apex Vertical Float  
Positive Drive

Multiple  
Drilling

## Just Like Hiring One Man to do the Work of Many

*That's the experience of plant  
executives who have adopted the*

### APEX Chuck

#### for Multiple Drilling and Tapping

It is greatly increasing production on multiple spindle operations. It makes possible a higher quality of work. It saves time, labor and money.

#### For Multiple Drilling

Here the APEX *positive* drive is supreme. Light, but rugged. Saves a tremendous amount of time in changing tools. Uses straight shank drills instead of taper shank.

#### For Multiple Tapping

On such operations the APEX *Vertical Float Positive Drive* sets new standards of chuck performance. Equally efficient for tapping holes of same or different lead to insure equal starting. Prevents pushing or dragging of taps.

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The APEX *Vertical Float Friction Drive* is producing marvelous results in tapping bottom holes and holes in tough metals. Unequalled also for multiple stud and nut setting. Equipped with free floating quick change collets. Insures true tapped holes.

#### Low Initial Cost

And there's a big saving in initial cost. Write for all the facts, including prices, details of proved performance.

**The Apex Machine Company**

301 Davis Ave., Dayton, Ohio

# BOKER KEYLESS DRILL CHUCKS



Your drilling machine operator *loses time* whenever he opens and closes a key operated chuck.

*Lose  
No Time*

Boker *Keyless* Drill Chucks open and close *faster*, using no other tools than the hands. Grip positively—drill shanks are never scored. Accurately made, concentric, perfectly balanced.

## List of Sizes

No.	Capacity
0	0 to 1/4"
1	0 to 3/8"
2	1/8" to 5/8"
3	0 to 9/16"

You can try a Boker Chuck  
30 days—free!

**H. BOKER & CO., Inc.**

103 Duane St., New York City, N. Y.

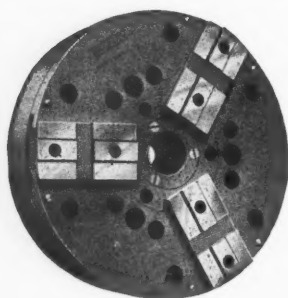
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## Good Chucking—Fast Work

Hopkins Air Operated Chucks are rigid gripping, powerful, fast—ideal for production operations. They secure greater accuracy in operation by holding the work nearer the spindle bearing, thereby reducing vibration.



Simple, dustproof construction insures long wear. Send for complete details of Hopkins Chucks and other air operated equipment.

**HOPKINS**  
PREFERRED EQUIPMENT

Chucks, Cylinders and Valves Operated by Air

MANUFACTURED BY

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Detroit Office: Haberkorn & Wood, 2208 West Fort St.

Chicago Office: Davis Tool & Equipment Co., 722 West Washington St.

## Magnetic Chucks for All Purposes

D & W Chucks are built in flat and rotary types, for all purposes and all kinds of machines. There are models to hold anything you want held—from piston rings to big planer work—with unmatched efficiency and security.



Write for the D & W  
Chuck catalog.

**J. & H. ELECTRIC CO.**  
161 Clifford St.  
PROVIDENCE, R. I.



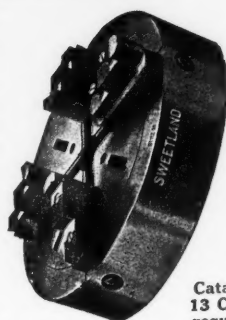
## SWEETLAND CHUCKS

To convince yourself of the superiority of Sweetland Chucks, try one on an odd-shaped part. Reversible jaws that work independently or universally will hold it securely under the heaviest feeds and cuts. If the Sweetland won't hold it—it can't be chucked!

Sizes 6" to 24" in 3" steps, and to 42" in 6" steps.

Catalog 13C on request.

**The Hoggson & Pettis Mfg. Co.**  
NEW HAVEN, CONNECTICUT



Catalog  
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request

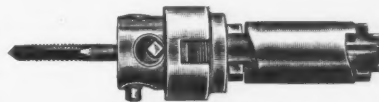
## Graduated Adjustable Friction Self-Centering Tap-Holder for Turret Lathe

**TAPS STEEL as safely as Cast Iron**

Regulates the Whole Power of Machine to Just Drive, but Cannot Break Tap. When Tap Sticks (or strikes Bottom) the FRICTION SLIPS, and Tap can thus be Run In and Out until the Toughest Metal is Quickly Tapped.



Interchangeable Spring Shanks for Rough and Finish Taps occupying One Turret Hole



Double Clutch Sleeve

Especially Good for Tapping Bottom Holes, Running Solid Dies Up Against a Shoulder, etc.

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New York Office: 200 Broadway

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Chicago Office: 549 W. Washington Blvd.

Catalog Francais: Edgar Bloxham, Paris, 12 Rue du Delta

## "PROCUNIER"

Safety Tapping  
Attachment Style "A"  
with  
"Double-Jaw" Chuck



Grips and drives the tap by the square, holds it in alignment by the round of the shank.

Balanced, all hardened gear reversing mechanism twice its forward speed, hardened steel clutches and renewable bearings insure long service. Patented Sensitive Safety Friction which slips when the tap sticks, eliminates breakage, reduces tapping costs.



Send for Catalog M for complete details of "Procunier" Quick Change Chucks, Stud Setting Tools and Tapping Devices.

**Procunier Safety Chuck Co.**

14-18 Clinton St., SO. CHICAGO, ILL.

Dealers in all principal cities of the United States, Canada and Europe.



**"LOGAN"**  
Air Chucks  
Increase Production

"Logan" Air Chucks and Air-Operated Devices often double production on an important operation. Adaptable to almost any workholding,—loading,—ejecting operation or production-cycle element, they eliminate waste motion, save time and labor. Catalog R-22 describes the complete line. Let us send you a copy.

**THE LOGANSPORT MACHINE CO.**  
529 Market Street LOGANSPORT, IND.

### ITS USE

A good one for your driller, miller, shaper or planer.

The attachments mean that you can do much duplicate drilling without the cost of a jig.

Any vise will pay. More time is consumed in catching work than drilling it.

## DRILL VISE

MOV. PLATE FOR SINGLE BUSHING  
MAKE PLATE FOR SEVERAL BUSHINGS  
AND TO SUIT THE WORK

ADJUST.  
BUSHING  
HOLDER  
STAND

HOLES FOR  
BUSHING  
PLATE

STOP  
HOLDER

STOP  
ROD

STOP

"BUSHINGS INTER-  
CHANGEABLE ANY  
SIZE UP TO 1 1/16"

MALL  
IRON  
HANDLE

Fig. 1.  
With Jig  
Attachments

Fig. 3.  
V-Jaw for Round  
Work

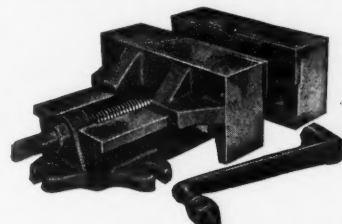
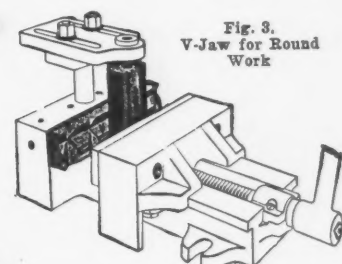
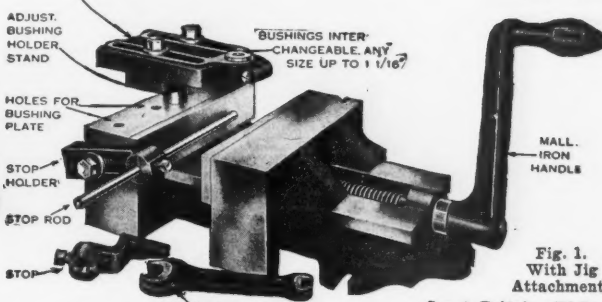


Fig. 2. Without Jig Attachments



**THE GRAHAM MFG. CO., PROVIDENCE, R. I.**

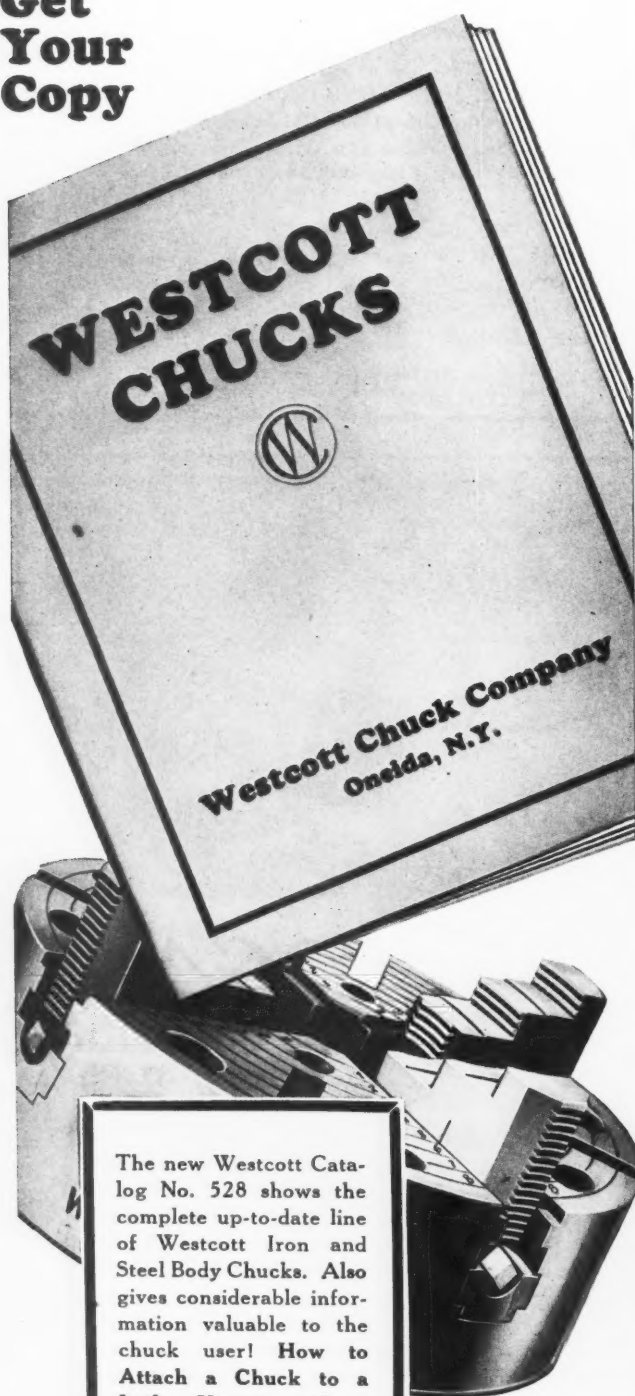
### LIST (Subject to Discount)

No. 3, Jaws 6" long, Fig. 1, \$45.00, Fig. 2, \$40.00  
No. 4, Jaws 9" long, " \$60.00, " \$54.00  
No. 5, Jaws 12" long, " \$85.00, " \$75.00  
V-Jaws extra. No. 3, \$5.00; No. 4, \$7.50; No. 5  
\$10.00 each. One V-Jaw is usually sufficient per vise.

Great Britain—Richard Lloyd & Co., Ltd., Birmingham  
France, Italy, Switzerland, Spain and Holland—Fenwick Freres & Co.  
Germany—A. Kayser, Oranienstrasse, 126, Berlin



**Get  
Your  
Copy**



The new Westcott Catalog No. 528 shows the complete up-to-date line of Westcott Iron and Steel Body Chucks. Also gives considerable information valuable to the chuck user! How to Attach a Chuck to a Lathe; How to make a Finished Adapter from the Rough Casting; If the Spindle is Light and the Chuck Heavy, etc.

**WESTCOTT  
CHUCK CO.**  
ONEIDA, N. Y.

*Send for a copy for your file.*

# WESTCOTT CHUCKS

## Greater Rigidity for effective bench work

REED Vises have sufficient weight and the right distribution of it to give rigidity and strength in the jaws and body.



This gives you a firm, rigid vise for chipping, filing, bending, etc. No spring or recoil. All the force of the blow is expended on the object in the vise.

Will be glad to send you our Vise Book, which points out some real economies.

**Reed  
Manufacturing  
Company,  
Erie, Pa.**

# REED

**Vises, Stocks,  
Dies, Etc.**

## The Pronto Quick Operating and Wide Opening Lever Vises

Designed for Milling and Drilling Machines and are especially adapted for any work where a large number of pieces are to be quickly handled. **MADE IN THREE SIZES.**



No. 1 6 3/4" long - 8 lbs. \$50.00  
No. 1 1/2 8 3/4" long - 17 lbs. \$60.00  
No. 2 9 3/4" long - 33 lbs. \$70.00

Prices subject to discount of 45%.

Manufactured by

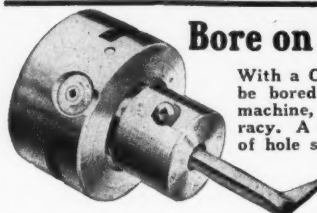
**EDW. PURVIS & SON**

110 YORK ST. Successors to Carter & Hakes BROOKLYN, N. Y.



High Speed Tapping Devices  
Quick Change Chucks  
Stud Setters  
Nut Setting & Screw Driving Chucks.

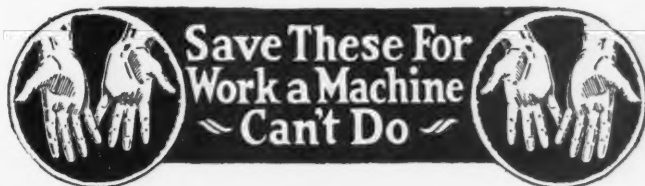
**The Charles L. Jarvis Co.**  
PORTLAND, CONN.  
P. O. Address Gildersleeve, Conn.



## Bore on the Milling Machine

With a Casler Offset Boring Head, work can be bored accurately to size on the milling machine, saving time and promoting accuracy. A complete tool covering a wide range of hole sizes. Send for Bulletin.

**HERMAN CASLER**  
CANASTOTA, N. Y.



## A Light Weight Tool That Does Heavy Work



Haskins H-6 Equipment

Branch Offices  
in Principal Cities

HASKINS Flexible Shaft Equipment is rapidly being adopted for general shop use as a result of comparisons with other types of power-driven tools. In no other way is it possible to secure *hand-tool flexibility coupled with power*.

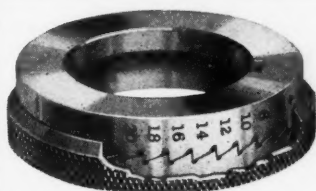
Here is tool equipment which offers all the convenience and facility-of-use of a hand-tool. It is light in weight and portable; it permits the tool to be carried to the job—to be used with ease in hard-to-reach places. And the tool is driven electrically, through a flexible shaft, by a high-powered motor with more than ample driving force for the heavy jobs.

HASKINS Flexible Shaft Equipment is available in every type required for every class of work. Pedestal mounted (low or high) where required, on easy-rolling castors enabling movement from job to job. Countershaft drive (integral) where varying speeds are necessary. Ball-bearing and roller-bearing mountings for power, speed and long wear. Quality throughout for trouble-free performance and upkeep economies.

You will want specific information on equipment designed to *your actual needs*. This will be mailed *quickly* upon request. Our new catalog is just off the press. Write for it.

**R.G.HASKINS COMPANY**  
Portable Flexible Shaft Machinery

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### "SCULLY-JONES" ADJUSTABLE SPACING COLLAR

For Milling Machine Arbors  
Hardened Ground

SAVE SET-UP TIME

Make positive and parallel adjustments in steps of .002" without removing cutters from arbor. Stock sizes for  $\frac{3}{4}$ " to  $2\frac{1}{2}$ " arbors, sent on approval. COMPLETE DESCRIPTION in our NEW SMALL TOOL CATALOG NO. 36 describing a greater variety of "SCULLY-JONES" PRODUCTION TOOLS is now ready. Send for your copy at once.

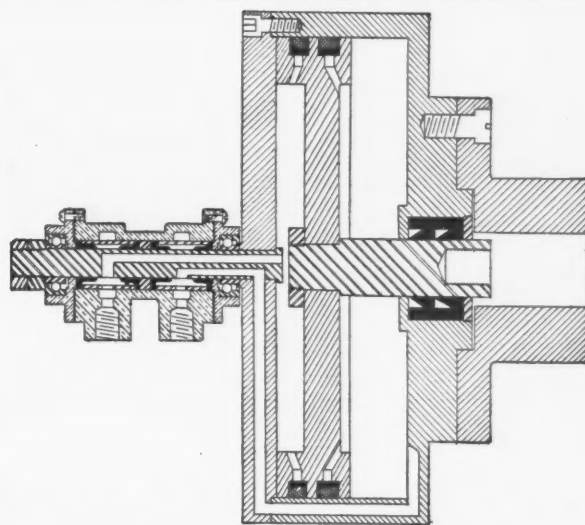
**SCULLY-JONES & COMPANY**  
TOOL DIVISION  
1911 So. Rockwell St. CHICAGO, ILL.

### We are ready to give you complete data on the new Deckel Type GK-1 ENGRAVING MACHINE

The only GENERAL PURPOSE MACHINE for light and heavy engraving on flat or spherical surfaces that is equipped with new mechanical features for cutting plastic designs in dies and molds, metal, wood, ivory, bakelite or other materials.

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**SCREENS OF ALL KINDS**  
Chicago Perforating Co.  
2445 West 24th Place  
Tel. Canal 1457 CHICAGO, ILL.



## AIRGRIP BALL BEARING CYLINDERS

Save Air, Labor, Power and Packing

Cylinder is kept constantly airtight by air-pressure itself. The air does the work—adjustment is automatic. Power is saved by the use of ball bearings. There is less than one-half the usual wear on packings.

Completely descriptive booklet sent on request.

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We Build Flexible Shaft Machines in Many Types and Sizes and for Many Uses.

Type M7—1 H.P. Capacity.



Established 1905

Our Wire Core Shafts are Known the World Over for their Strength and Durability.



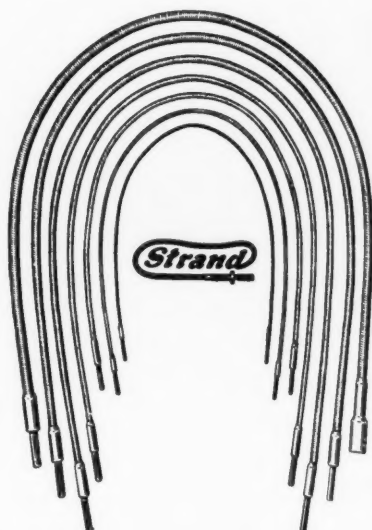
Capacities  
From 1/10 H.P. to 2 H.P.

## Portable Flexible Shaft Machines FOR THE FOUNDRY MACHINE SHOP METAL PATTERN SHOP AND INDUSTRIAL PLANTS OF ALL KINDS

Grinding - Polishing - Buffing - Drilling - Scratch Brushing - Rotary Filing. Surfacing - Lathe - Planer and Shaper Grinding Attachments.

Screw Driving and Nut Setting Machines.

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Represented in every principal city of the United States and many foreign countries.

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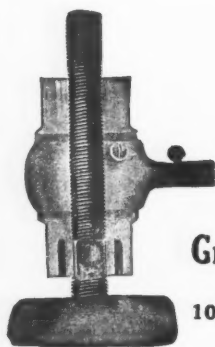
## Time saving is only one of the features of the Favorite Reversible Ratchet Wrench

Has opening clear through wrench head, allowing bolt to pass through it, and so run the nut down any distance.

The ratchet movement insures quick straight ahead work without the usual lost motion of nut turning.

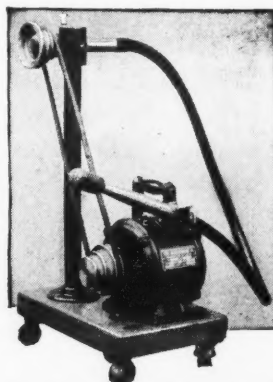
It cannot slip off the nut, as socket form of head grips the nut on all sides.

BUILT  
STRONG  
FOR  
ROUGH  
USAGE



Let us give  
you full  
particulars

Greene, Tweed & Co.  
Sole Manufacturers  
109 Duane St. New York  
Tool Department



## "The Lindy" Three Speeds \$60

1/4 H.P. Motor, 110 volts, 60 cycles, 1 phase to operate from a lighting line, price \$60.00. For die-sinking, metal and wood working, sanding, rotary file, machine and pattern shops. Furnished in three sizes.

Write for Bulletin 400

Inventors and built exclusively by

STOW MANUFACTURING CO., Inc.  
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## Flexible Steel Tubing

For carrying coolant on machines.  
All steel construction. Durable

Sizes: 1/8-, 1/4-, 3/8- and 1/2-inch inside diameter.

WHELOCK MFG. CO., Wheelock, Vt.

OF ANY SIZE  
AUTOMATICALLY CUT

# DIES

by the **KELLER METHOD**

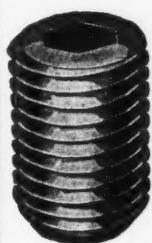
**KELLER MECH. ENG. CO.** **KME**

74 WASHINGTON ST. BROOKLYN, N.Y.



# DIFFERENT?

## Yes!



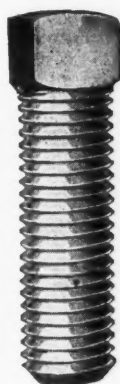
Mac-it Screws don't lose their heads, don't strip their threads, don't mushroom at the point, don't cause trouble.

—But they do give long, satisfactory and economical service.



This is due to:

1. Mac-it special Alloy Steel—
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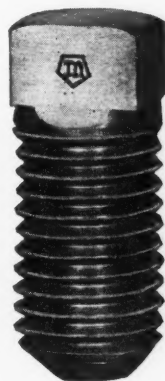
### Mac-it

SET SCREWS



are accurate in pitch and lead — strong throughout their structure, the toughest screws made.

Ask your dealer for Mac-its, or write—



THE  
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& HAMMOND CO.

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CLEVELAND, OHIO

Write for catalog descriptive of  
Mac-it products.



## Why Doehler fastens with Hardened Metallic Drive Screws

FOR a number of years, the Doehler Die Casting Co., of New York, has been a large user of Parker-Kalon Hardened Metallic Drive Screws. They use these Screws for numerous assemblies on practically all of their vending machines, because, as their chief engineer says, "they lend themselves very readily to die castings and save a tapping operation in many cases."

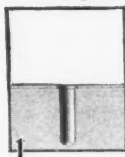
In the typical application illustrated, Drive Screws have two important advantages. First, they eliminate tapping and preclude the possibility of stripping threads and thereby spoiling this expensive piece. Second, they provide the easiest and quickest means of making the fastening. The Screws are merely inserted into holes which have been molded in the casting and driven in with a hammer, cutting their own thread, like a tap.

Drive Screws are being used by thousands of concerns, in every branch of the metal working industry, because they eliminate costly tapping operations and make better—stronger—fastenings than machine screws, escutcheon pins, rivets, etc.

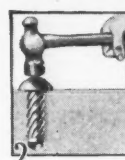
Tell us what you want to fasten and we will send samples for test without cost or obligation.

PARKER-KALON CORP., 200 Varick St., New York, N.Y.  
Distributed in Canada by Aikenhead Hdw. Ltd., 19-21 Temperance St., Toronto

Easy to use—  
no skill required



1 Drill a hole.



2 Hammer in the screw.

## Parker-Kalon



TRADE MARK  
Hardened Metallic  
REG. U.S. PAT. OFF.  
Drive Screws

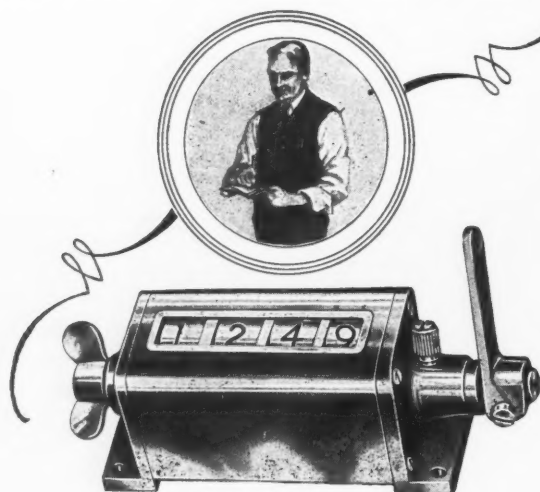
Parker-Kalon Corporation  
200 Varick St., New York  
Please send me a handful of Hardened  
Metallic Drive Screws. I want to try  
them out for

Name .....  
Address .....  
.....

# Veeder-ROOT

## COUNTERS

Turn the idle  
hours  into  
production-hours  
by recording  
the output   
where it's watched,



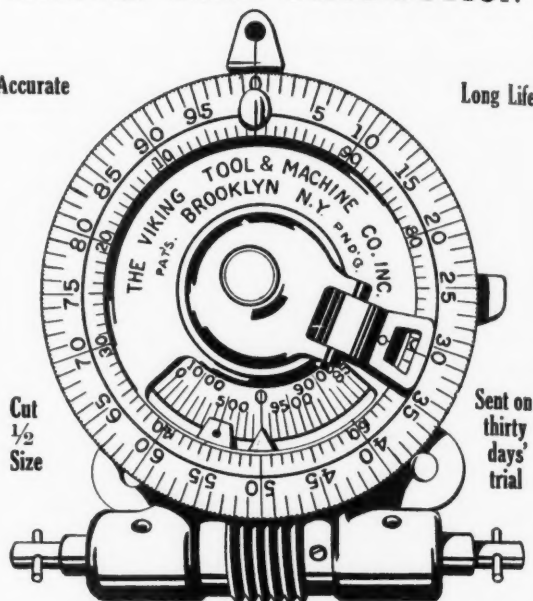
The *Revolution Set-Back Counter* above records the output of any machine where a shaft-revolution indicates an operation. Sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price, with four figures, as illustrated, \$10.00—subject to discount. Large Set Back Rotary Ratchet Counter to count reciprocating movements where these count the product, \$11.50. Write for Booklet M.

Veeder-ROOT INCORPORATED  
HARTFORD, CONN.

## INSURE YOUR PRODUCTION

Accurate

Long Life



Cut  
1/2  
Size

Sent on  
thirty  
days'  
trial

### VIKING HIGH SPEED STOP CONTROL COUNTERS

Counters that are positive and will not trip or skip counts at high speed. Electrical, Mechanical and Plain Models. Electrical model operates make or break circuit switch 110-V, 220-V, and 500-V direct to your motor or as remote control to your motor starter.

The Viking Tool & Machine Co., Inc.  
749 Sixty-fifth Street  
BROOKLYN, N. Y.

## Two Ways to Save



Osgood Indestructible File Handles outlast the ordinary kind many times because made with a steel inner tube which receives the file tang and

takes all strain off the wood. Osgood File Handles stand up in the hardest service—an added convenience is the Kant Slip Ring which positively prevents the handle from coming off.

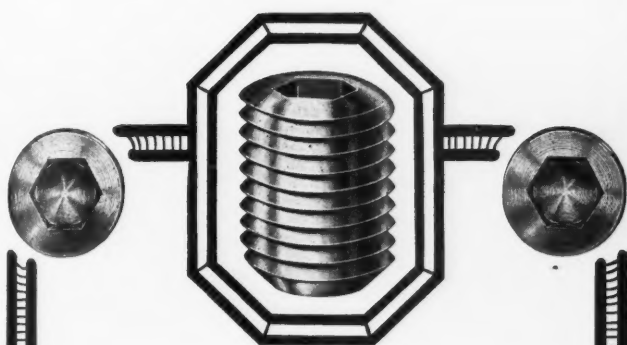
And for protecting the other end of the file—the Osgood Safety File Grip—a soft rubber tip which makes filing easier and safe.

Write for catalog of these and other  
Osgood Tools and Specialties

J. L. Osgood Tool Company

43-45 Pearl Street

BUFFALO, N. Y.



## All to the Good

Out of every hundred hollow screws, how many can you positively count on as up to the quality of the *best*?

*All* of them—if they're "ALLENS." In every hundred Allen screws there is just one brand of quality; no variations.

Uniformly perfect hexagon *sockets*; the same socket-depth in every screw; the same perfect fit for the wrench.

Uniformly accurate *threading*; all screws threaded to No. 3 National Thread Association specifications.

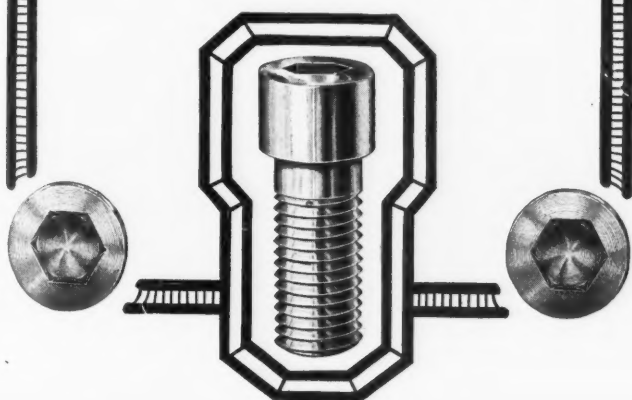
Uniform *heat-treating*; no brittle screws to crack under strain; no soft ones to ream out or mushroom.

Each "Allen" you buy is *individually inspected*, and screws that pass this examination will pass every test in practical use—to the last one in the lot!

**The Allen Mfg. Co.**  
125 Sheldon St., Hartford, Conn.

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"We are daily saving money through the use of American Swiss Files."

—a prominent carburetor manufacturer.\*

"After twelve years of constant use we are pleased to say we save approximately 30% on file costs by using American Swiss Files."

—a well known machine manufacturer.\*

"The American Swiss Files play an important part in our work and aid us to maintain the high standard of quality for which our products are known."

—a high grade tool manufacturer.\*

"We can always depend on them being true temper and uniform throughout and we are well satisfied with them."

—a leading tractor manufacturer.\*

"We have found them to be uniformly satisfactory as to quality, life and cost."

—a Detroit auto parts manufacturer.\*

\*from letters on file in our Elizabeth office.

American Swiss Files have been the choice of discriminating mechanics for over 27 years.

They have learned to know from experience that the American Swiss trade mark on files of precision guarantees uniform temper and quality.

When you buy files look for this trade mark. It is your assurance of quality and long life.

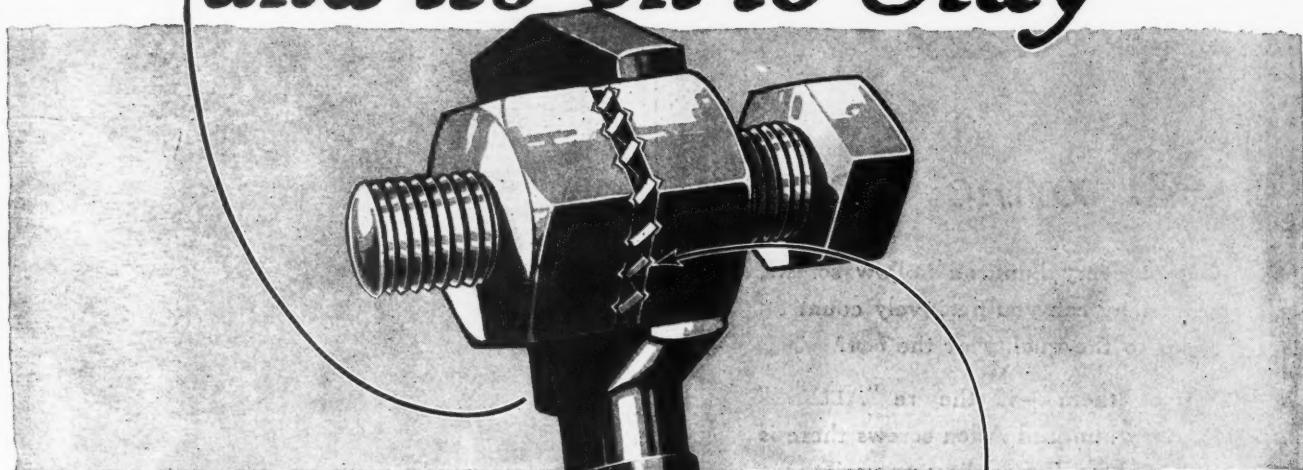
Write for Booklet "Files of Precision."

**American Swiss File & Tool Co.**  
410-416 Trumbull St., Elizabeth, N. J.

*Also manufacturers of high grade hand tools for mechanics. Write for Tool Catalog.*



# *A Turn of the Wrench and it's on to Stay*



Each twisted tooth assures two positive locking contacts, thus forming a series of multiple locks around the entire circumference of the washer " " "

## **Multiple-Locking Tangleproof Spreadproof**

No other washer has these features. No other washer is so widely O.K.'d by automotive engineers. They know it makes positive, permanent connections because the twisted teeth set around the circumference form a series of actual and multiple locks. Why not prove its superiorities by sending for sample lot of this engineered lock washer? They're free.

**"NOT A TANGLE IN A TON"**



TYPE 11



TYPE 12



TYPE 15

## **SHAKEPROOF LOCK WASHER COMPANY**

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CHICAGO, ILLINOIS

# \$20,000 plant expansion with an investment

**STEWART DIE CAST-  
ING** service produces many definite advantages in the manufacture of hundreds of different types of product, each advantage contributing to the major feature of over-all economy.

*Production economies include:*

- Reduced unit costs.
- Simplified design.
- Complete interchangeability and simpler, faster assembly.
- Release of manufacturing facilities for other work.
- Release of working capital.
- Elimination of manufacturing "grief."

*Improvements in finished products are:*

- Better finish.
- More striking sales features.
- Enhanced performance based upon accuracy and simplicity of design.
- Fewer adjustments and less "free service" required.
- Improved performance as a result of detail improvements possible with the Stewart Die Casting process.

Stewart engineers are specialists in die design and in the adaptation of products to production as die castings. Their services are available to manufacturers without charge. The Stewart plant is the largest in the world devoted exclusively to die casting. Automatic machinery, principally of Stewart design, and an organization highly trained in the Stewart process insure economy, accuracy and unrivalled standards of service.

## of less than \$500

**O**NE manufacturer using Stewart Die Castings for two parts in his product literally established a much-needed new department overnight with an investment of about 2½% of the value of the equipment.

Machine tools, shop space, and working force, formerly used in the production of parts now die-cast by Stewart process, were converted to the manufacture of other portions of the assembly at a cost but a fraction of what an equivalent new installation would have been.

Stewart Die Casting service has many advantages, which make "cost per piece" savings insignificant by comparison.

Investigate these advantages from the standpoint of your own requirements. Stewart service can help you to double-up plant facilities and meet present-day competition. Send blueprints, or a sample and Stewart engineers will furnish definite recommendations.

### *The Stewart Die Casting Corporation*

4500 Fullerton Avenue Chicago, Illinois

DETROIT CLEVELAND MILWAUKEE DAYTON  
NEW YORK CITY ST. LOUIS PITTSBURGH

# Stewart

M8-Gray



Specify J & J Forgings on your next order. Send blueprints for estimate.

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Spindles  
Arbors  
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You can depend upon J. & J. Forgings to be on hand when promised—and you can depend upon their unvarying high quality also. Economical—made very close to finished dimensions, saving metal and machining time.

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INCORPORATED 1894

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*Extremely Resistant to Wear*

McGill Metal is a tough, hard bronze of high tensile strength which exhibits a remarkable resistance to wear. The pieces shown are ball bearing retainers. When made of McGill Metal these parts reduce friction—are lighter, stronger—and more durable. Spur, worm and bevel gears and feed nuts may advantageously be made from McGill Metal.

Ask us to tell you how McGill Metal Castings will improve your product and reduce costs.

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Quality forgings—rough finished or machined, plain or heat treated—in any size up to 2 tons.

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Die Castings in Aluminum, Zinc, Tin and Lead Alloys  
If You Value Quick Action and Real Cooperation, Let us Quote.  
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## DIE-CASTINGS Standard Alloys

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# Ability

—and horse sense

☞ Genius is often erratic, level-headedness often dull. But combine the two, and you have an unbeatable combination.

☞ We claim these attributes, and have demonstrated them—often repeatedly—to the satisfaction of many leading manufacturers during our twenty-two years of business. Our dies, tools, fixtures and special machines reflect it—as does our plant and our choice of workmen.

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Die-castings made from aluminum, zinc, tin and lead base alloys.

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**FRANKLIN**  
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**ALUMINUM DIE CASTINGS**  
of ALCOA ALUMINUM

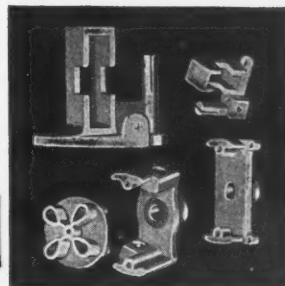
*For Strength, Lightness, Economy*

**Lower your production cost—  
increase your output**

A specialist will consult with you on request. No obligation, of course.

**ALUMINUM COMPANY OF AMERICA**  
2437 Oliver Building Pittsburgh, Pa.

Better  
Methods



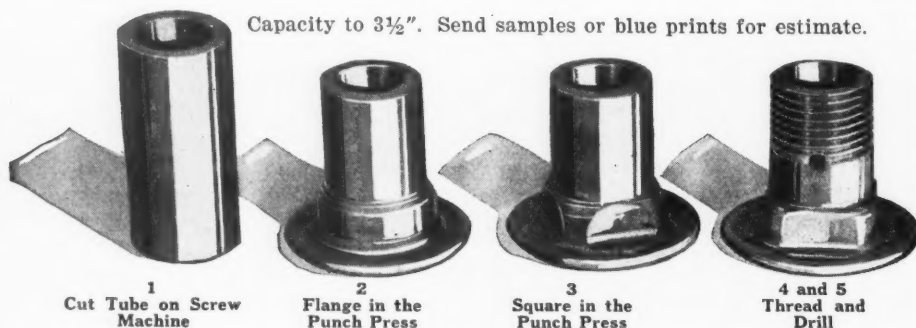
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Castings



SuperCast  
since  
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**The Superior Die Casting Co.**  
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## Small parts produced by Poorman Methods



Capacity to 3½". Send samples or blue prints for estimate.

Simplified production methods plus unvarying accuracy in each operation enable Poorman to produce small screw machine and stamped parts with unusual economy and complete satisfaction.

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By intelligent engineering we stand ready to increase your production, thereby reducing your cost to its lowest level.

With us the first cost is the only cost.

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A staff of highly specialized engineers, and a well trained drafting force are at your disposal.

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Engineers and Builders of High Grade Tools,  
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**JIGS, FIXTURES, DIES, GAGES  
AND SPECIAL MACHINES**

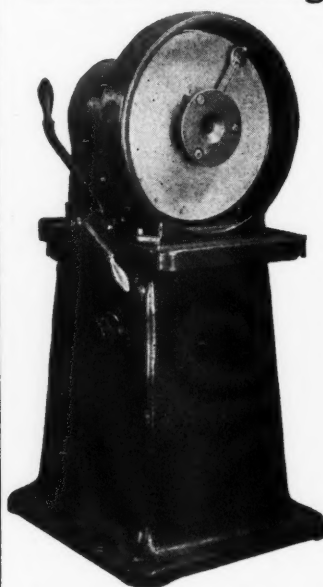
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Established 1913

30 Minutes from New York City ROSELLE, NEW JERSEY

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The M.C.E. Centrifugal Babbitting Machine casts the bearings in connecting rods in far less time than the same operation can be done in the usual way. Sounder, more homogeneous bearings are produced, free from hard spots and holes. Impurities are deposited at the inside surface where the first machining operation removes them.

The machine is ruggedly constructed throughout and easy to operate. Seventy-five bearings, 2½" x 1-9/16", babbitted in an hour is a representative performance.

**Production  
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Engineers and Designers—  
Known as

**Manufacturers' Consulting Engineers**  
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on tools that incorporate the Five Fundamental Tool Virtues. As a result we offer to make for you:  
Tools that are time saving. Tools that are foolproof. Tools that are easy to manipulate. Tools that will give largest possible production. Tools that will give absolute interchangeability.

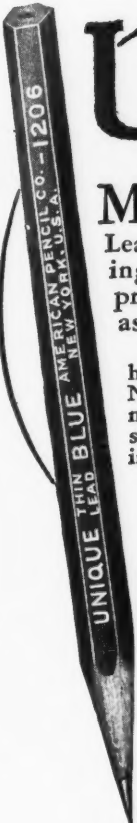
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A CARD WILL BRING OUR CATALOG



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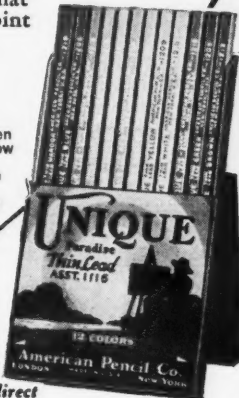
These hexagon shaped wooden pencils have colored leads of the same diameter as No. 1 black writing pencils—firm, smooth, non-crumbling leads that sharpen to the finest point in a pencil sharpener.

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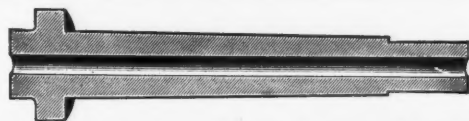
Blue	Orange	Olive Green
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The Watts method of *drilling* triangular, square, hexagonal and other holes is faster, cheaper and unusually more accurate than other methods of doing the work. A practical operation with simple, practical tools. Let us tell you about it.

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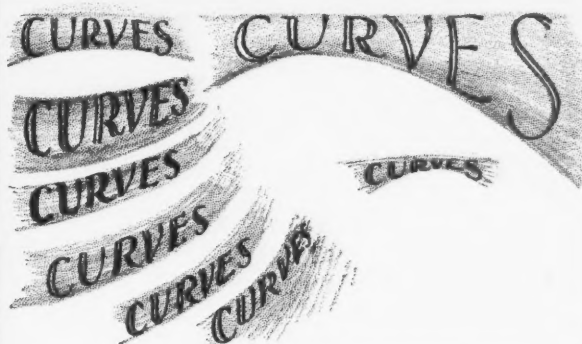
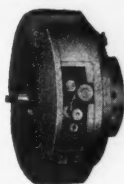


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use the M-D Facing Head; it faces like a lathe, has a single point tool which travels radially from center outward or reverse; feeds automatically and faces diameters from 6" to 24".

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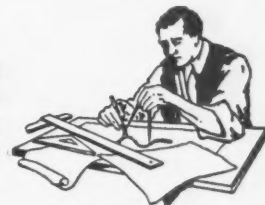


**CURVES, CURVES**  
*everywhere—you have frequent use for them in your work.*

## K & E FLEXIBLE CURVE RULES

represent a radical departure in curve-rule construction. Two rows of holes, slit to the edge, make the black xylonite very flexible.

On one edge is a ruling strip of xylonite, and on the other a metal wire to keep the curve at which the rule is bent.



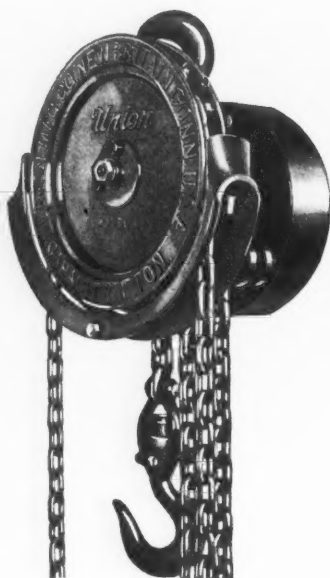
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All Cut Gears.

Made of best steel and carefully  
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Highest Grade of Chain.

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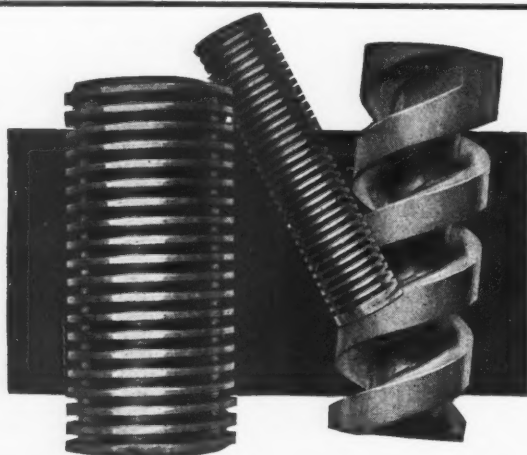
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*Accurate—Durable*

The precision of any machine is no better than that of the feed and lead screws in it. Hindley Screws are accurately cut, wear-resistant and tougher than most—because made by a special process which causes minimum disturbance of metal structure in cutting. Your machine will be a *better* machine for being equipped with Hindley Screws.

Power, lead and feed screws—any length—any thread. Let us quote on your needs.

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*When you buy Wrenches—  
don't experiment*

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Three models. Sizes from 6 inches to 6 feet.  
At good dealers everywhere.

### COES WRENCH COMPANY

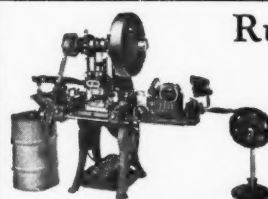
Established 1841

WORCESTER,

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### Runs of 5000 Pieces

may now be made more economically with Littell Roll Feeds, according to some of the more progressive radio manufacturers. Complete information free on request.

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### Hjorth Perfection Spring Winder

No factory complete without one. Makes every kind of springs. Right or left-hand.  
Capacity to 3/32 wire \$1.25  
Capacity to 3/16 wire 2.50  
Capacity to 5/16 wire 5.00

*If interested,  
send for circular.*

**Hjorth  
Lathe & Tool  
Company**

24 School St.  
Boston, Mass.  
Works:  
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(Patented)

Hardware Agents Wanted

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## SURPLUS PLANT EQUIPMENT

Many Modern Machines. Some Practically as Good as New  
All Motor Driven Equipment 220-volts D. C.

Communicate with our nearest office for prices. All items at Ridgway, Pa., except those marked "H" which are at Hamilton.

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13"x5' Blount Speed Lathe, Belt.  
28"x30' Pond, Motor.  
H—27"x12' Pond "Time-Saver," arr.  
for var. sp. motor.  
H—36"x18' Pond All Geared, Motor.

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3"x36" P. & W., Belt.  
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42"x42"x26' Pond, 4 Hds. Rev. M.D.  
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H—36"x36"x10' Pond, 3 Hds. R.M.D.  
H—36"x36"x12' Pond, 4 Hds. R.M.D.  
H—36"x36"x14' Pond, 2 Hds. R.M.D.  
H—36"x36"x14' Pond, 4 Hds. R.M.D.  
H—42"x42"x14' Pond, 4 Hds. Belt M.D.  
H—42"x18"x20' Pond, Ex. Hy. Frog and Switch, 2 Hds. R.M.D.

### Shapers and Slotters

22" Bement Slotter, Motor.

### Upright and Radial Drills

No. 1 Bement Vert. Cotter Drill, Belt.  
5' Right Line Full Univ., Motor.  
6' Ridgway, Plain, Motor.  
H—5' Niles Universal Radial.  
H—6' Niles Universal Radial.

### Millers

Whitney Hand Miller, Belt.  
No. 4 Cincinnati Univ., Motor.  
No. 6 Becker-Brainerd Vertical, Belt.  
6"x132" P. & W. Thread Miller, Belt.

### Grinders—Cylindrical and Tool

LeBlond No. 1 Cutter, Belt.  
No. 2 Sellers Tool, Belt.

### Emery Wheel Stands

No. 6 Blount Grinder, Belt.  
18" 3-hd. Comb. Grinder and Polisher Belt.

18" Emery Wheel Stand, Belt.  
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24" Gleason Bevel Gear Planer, Belt.  
36" No. 4 B. & S. Spur Gear, Belt.

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3 1/2" Sp. Ridgway Hor. Motor.  
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5 1/2" Sp. 80" Bement Horiz. Belt.  
H—38"-44" P. & W. Side Head, belt or motor.  
H—14" Niles, with R. H. Tur. Hd. Motor.

### Miscellaneous

Bement 1100 lb. Single F. Steam Hammer.  
Espin-Lucas Cold Saw 4" Cap. Belt.  
Williamsport No. 190 Railway Cut-Off Saw, Belt.  
100-card Dey Time Register Clock.  
Y & T 3-ton Hand Crane 35' 6" span.  
H—7 1/2"x 7 1/2" Cap. 12" Throat, L. & A. Horiz. Punch, Motor.  
H—185-lb. Motor Driven Air Hammer.

### Foundry Equipment

7"x14' Norcross Jolting Mach.  
20" Norcross Jarring Mach.  
14"x16" Mumford Molding Mach.  
Sellers Centrifugal Sand Mixer, Motor.  
Whiting No. 40, 36x53" Tumbler, Belt.  
20-Ton Std. Worm Gear Ladle.  
10-Ton Std. Worm Gear Ladle.  
4-Ton Std. Worm Gear Ladle.  
No. 6 Whiting Cupola.  
No. 9 1/2 Whiting Cupola.

### Woodworking Equipment

20"x12' Clement Pattern Lathe, Belt.  
24"x12' Clement Pattern Lathe, Belt.

### Niles Electric Traveling Cranes

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10-Ton, 3-Motor, 34' 8" Span.  
30-Ton, 4-Motor, 34' 8" Span, 5-Ton aux.  
25-Ton, 4-Motor, 71' 11" Span, 5-Ton aux.  
40-Ton, 4-Motor, 71' 11" Span, 5-Ton aux.  
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Lathes, 20" x 10' Hamilton, quick change.  
Lathe, 21" x 10' LeBlond.  
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Milling machines, No. 1 Kempsmith universal.  
Milling machines, No. 2 and No. 3 Kempsmith plain.  
Milling machines, No. 2 heavy B. & S. plain.  
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Planer, 42" x 42" x 12' Gray, motor driven.  
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Grinder, 16"x72" Landis Plain, mtr. dr.  
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Univ. Miller, No. 3 Cincinnati, 34"x9"x20" belt dr.  
Vert. Miller, No. 2 Cincinnati, 28"x12"x17" belt dr.  
Rotary Planer, No. 1 Espen-Lucas, H.D. Hydr., mtr. dr.  
Plate Planer, 16" No. 3 Niles, belt dr., Special Price.  
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Planer, 42"x42"x10' Ohio, 2 hds. on rail.  
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Slitting Shear, No. 208 Niagara, 10 ga. cap.  
Punch Kiling, S.E., 24" thrt., arch jaw, cap. 3/4" in 3/4", mtr. dr.  
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24" x 14" Whitcomb-Blaisdell Grd. Hd. Q. C.  
22" x 10" Lodge & Shipley Selective Grd. Hd. Q. C. (Latest Type).  
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Nos. 4 and 3 Brown & Sharpe Univ.—C. P. Comp.  
Nos. 3 and 1 Hendey Univ.—C. P. Comp.  
No. 3 Kempsmith Univ.—C. P. Comp.  
No. 1 1/2 Valley City Univ. C. P. Comp.  
Nos. 4 and 3 Cincinnati High Power Plain—C. P. (Late Type).  
No. 3 Cincinnati High Power Plain Single Pulley—Power Rapid Traverse (Late Type).  
No. 3H and No. 2 1/2 LeBlond Plain—C. P. (Late Type).  
No. 3 Heavy Ohio Plain—C. P. Pr. R. Trav.  
Nos. 3 and 2 Cincinnati Plain C. P.  
Nos. 3 and 1 Kempsmith Pl. Rad. G. B. Dr.  
No. 1-B Brown & Sharpe Plain—Single Pulley.  
No. 4 Cincinnati High Power Vert. Single Pul.—Power Rapid Traverse. (Late Type).  
No. 3 Van Norman Duplex Miller.

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3" Cincinnati Plain Radial G. B. Dr.  
2 1/2" Gang Plain Radial G. B. Dr.  
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3" and 2 1/2" Carlton Ball Bearing Sens. Rad. Tap. Attach.  
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25" Snyder Upright Drill (Late Type).  
24" Cincinnati Upright Drill.  
24" Sibley Upright Drill.  
22" Superior (Kokoro) Hi-Speed Upright Drill.  
21" Cincinnati Upright Drill.  
No. 310 Baker Bros. Heavy Duty Drill.

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24" Ohio Heavy Duty B. G. Crank.  
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No. 6 Fellows Gear Shaper.  
No. 6 Gleason Bevel Gear Generator.  
No. 4 48" and No. 3 26" Brown & Sharpe Auto. Spur Gear Cutter.  
No. 3 Wilmarth & Marmon Auto. Surface—Magnetic Chuck.  
Walker Single Stroke Surface—10" Diam. Magnetic Chuck.  
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No. 18 30" Gardner Pattern Makers Disc.  
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15 Ton Lucas Power Forcing Press—Belt Dr.  
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Bolt Cutter, 1 1/2" Landis, M.D.  
Bolt Cutter, 1" Landis, BD.  
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Boring Mill, 42" Bullard, 2 heads.  
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Brake, 12'x14 ga. Chicago, M.D.  
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Drill, 3 1/2" Cisco.  
Drill, 4" Bickford Plain.  
Drill, 5" Cinti-Bickford Univ. M.D.  
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Gear Cutter, No. 12 Barber-Colman.  
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Lathe, 17x16" Sidney Q.C.  
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Lathe, 36x18" American Q.C.  
Lathe, 24x10" Lodge-Shipley Q.C.  
Lathe, 23x14" LeBlond Q.C.  
Lathe, 27x12" LeBlond Q.C.  
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Miller, No. 28 Ohio Plain.  
Miller, No. 3H LeBlond Plain.  
Miller, No. 2 Cinti Universal.  
Miller, No. 2 Kempsmith Universal.  
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Pipe Machine, 8" E-C-B, B.D.  
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Shaper, 16" New Queen City BG.  
Shaper, 20" Queen City, BG.  
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Shear, No. 196 Niagara.  
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18"x10" Star, belt feed. 250  
18"x10" Lodge & Shipley, quick change 375  
20"x10" LeBlond, quick change. 400  
20"x14" LeBlond, loose change, taper. 400  
22"x10" Niles, loose change. 300  
24"x16" Niles, taper. 280  
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3x36 Jones and Lamson, chucking. 250  
3x36 Pratt and Whitney Turret. 600  
No. 6 Foster Turret, air chuck. 350  
3' American Radial, cone drive. 475  
No. 1 1/2 Landis Universal Grinder, 250  
10x36" 200  
No. 1 Ott Universal Grinder, 8x18" 200  
20" Queen City Shaper, back geared. 500  
24" Barker Shaper, back geared. 400  
30x30x6" Gray Planer, two heads. 550  
No. 4-B Heavy Brown and Sharpe Plain Miller 1000  
52" Niles-Bement-Pond Boring Mill, Sg. P.D. 1000  
42" Throat Lennox Splitting Shear, 1/2" capacity 500  
24"x6" Ingersoll Slab Miller. 500  
50" Niles Heavy Vertical Drill. 350

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Auto. Screw Mach. Cincinnati 5 spdl 1/4" 900  
Auto. Screw Mach. Cleveland 5 Model A 150  
Screw Mach. No. 1 W&S, complete (6) 125  
Screw Mach. P & W 5/8 x 4, complete. 150  
Turret Lathe, 24" Steine 5" hole side carriage 700  
Boring Mill, Morris Horiz. motor drive, 1-15/16" spdl. 1000  
Boring Mill, 34" Colburn Vertical. 350  
Drill, 1 spindle L-G, 14" H. S. B. Bearing 175  
Drill, 4 spindle Avey H. S. B. Bearing. 350  
Drill, 4 spdl. Allen HS BB 350  
Drill, Radial 3' American Sensitive. 200  
Grinder, No. 1 Norton Universal Cutter and Tool, all attachments. 500  
Grinder, No. 65 Heald with fixtures B.B. spdl. 900  
Lathes, 14x8 Hendey Q.C. with taper. 500  
Lathe, 18x12 S. & B. Q.C. with chuck 500  
Lathe, 20x8 Rahn-Larmon, Q.C. w. chuck 350  
Lathe, 20x10 Bradford with chuck. 400  
Miller, No. 3-H LeBlond Univ. H.D. 1250  
Miller, No. 4-B Becker Vertical \$350— with rotary table 425  
Miller, Whitney, Stand. & U.S. (Hand) 125  
Miller, No. 12 P & W Automatic. 600  
Miller, Ingersoll Slab 42x36x9" 1750  
Press, No. 21 Holden O.B.I. 3700 lbs. 2 1/4" stroke 350  
Press, No. 3 Robinson O.B.I. 4300 lbs. 2" stroke 450  
Press, No. 5 R&K O.B.I. 5500 lbs. 2" stroke 525  
Hammer, 50 lbs. No. 1/2 Standard Drop 150  
Shaper, 7" Rhodes Horizontal. 150  
Shaper, 16" Stockbridge S. Geared. 50  
Planer, 32x32x8 Pond, 1 head. 750  
Planer, 36x36x8 Cincinnati Hvy. 2 hds. 1250  
Bolt Cutter, 2" D & H Double Head. 300  
Brake, No. 18 gauge GA x 6" Robinson 75  
Centering Machine Whiton Swivel. 100  
Filing Machine, Cochrane-Bly Floor Type 100  
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96" Betts bor. mill. 32" Superior upright drill.  
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No. 4 Cincinnati Vert. Mill.  
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No. 4 Williams White bulldozer.  
Nos. 2A & 3A Warner & Swasey, 3/4, 1 1/4 & 2 1/4 Gridley automatics.  
No. 12 Barber Colman gear hobber.  
Nos. 2 & 3 B & S Univ. millers.  
56"x42"x12" Cincinnati planer.  
36"x30"x10" Cleveland planer.  
Nos. 2 & 3 P. & W. die sinkers.  
4', 5', 6' & 8' Western radial drills.  
2 ton Automatic electric truck.  
No. 70 Heald internal grinder.

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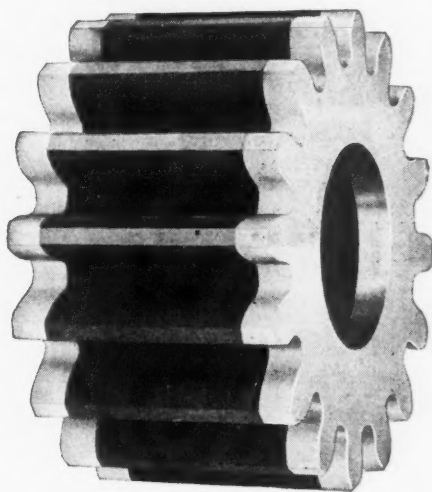


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# MACHINERY'S PRODUCT INDEX

FOR LOCATION OF ADVERTISEMENTS OF MANUFACTURERS LISTED IN THIS INDEX  
SEE ALPHABETICAL INDEX, PAGES 309-310

## ABRASIVE CLOTH AND PAPER

Carborundum Co., Niagara Falls, N. Y.

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See Hoists, Air.

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See Presses, Arbor.

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Nicholson & Co., W. H., 112 Oregon St., Wilkes-Barre, Pa.

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Morse Twist Drill & Mch. Co., New Bedford, Mass.  
National Tool Co., Cleveland.  
National Twist Drill Tool Co., Detroit, Mich.  
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See Boring Bars.

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## BAR, STEEL

Carnegie Steel Co., Pittsburgh, Pa.

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Boston Gear Wks. Sales Co., Norfolk Downs, Quincy, Mass.  
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Fafnir Bearing Co., New Britain, Conn.  
Federal Bearing Co., Inc., Poughkeepsie, N. Y.  
Gwilliam Co., Brooklyn, N. Y.  
New Departure Mfg. Co., Bristol, Conn.  
Norma-Hoffmann Bearings Corp., Stamford, Conn.  
Schatz Mfg. Co., Poughkeepsie, N. Y.  
S. K. F. Industries, Inc., 40 East 34th St., New York.  
Strom Bearings Co., 4563 Palmer St., Chicago, Ill.  
Torrington Co., Torrington, Conn.  
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Buckeye Brass & Mfg. Co., Cleveland.  
Bunting Brass & Bronze Co., Toledo, Ohio.

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Link-Belt Co., Chicago, Ill.  
Medart Co., St. Louis, Mo.  
Roversford Fdry. & Machine Co., Box M., Roversford, Pa.  
Wood's, T. B., & Sons Co., Chambersburg, Pa.

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Fibroc Insulation Co., 1023 Lincoln Ave., Valparaiso, Ind.

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Gwilliam Co., Brooklyn, N. Y.  
Hyatt Roller Bearing Co., Newark, N. J.  
Medart Co., St. Louis, Mo.  
Norma-Hoffmann Bearings Corp., Stamford, Conn.  
Roversford Fdry. & Machine Co., Box M., Roversford, Pa.  
Shafer Bearing Corp., 6501-99 W. Grand Ave., Chicago.  
Timken Roller Bearing Co., Canton, O.

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Medart Co., St. Louis, Mo.  
S. K. F. Industries, Inc., 40 East 34th St., New York.  
Wood's, T. B., & Sons Co., Chambersburg, Pa.

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Medart Co., St. Louis, Mo.  
Timken Roller Bearing Co., Canton, O.

## BEARINGS, THRUST

Auburn Ball Bearing Co., 33 Elizabeth St., Rochester, N. Y.  
Ball & Roller Bearing Co., Danbury, Conn.  
Bearing Co. of America, Lancaster, Pa.  
Boston Gear Works Sales Co., Norfolk Downs, Quincy, Mass.  
General Electric Co., Schenectady, N. Y.  
Gwilliam Co., Brooklyn, N. Y.  
Medart Co., St. Louis, Mo.  
Norma-Hoffmann Bearings Corp., Stamford, Conn.  
S. K. F. Industries, Inc., 40 East 34th St., New York.  
Timken Roller Bearing Co., Canton, O.

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Chicago Rawhide Mfg. Co., 1279 Elston Ave., Chicago.  
Graton & Knight Mfg. Co., Worcester, Mass.

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Hoggson & Pettis Mfg. Co., New Haven, Conn.  
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Chicago Rawhide Mfg. Co., 1279 Elston Ave., Chicago.  
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Chicago Rawhide Mfg. Co., 1279 Elston Ave., Chicago.

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Buffalo Forge Co., Buffalo, N. Y.  
Consolidated Machine Tool Corporation of America, Rochester, N. Y.  
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See Hoists, etc.

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Chicago Flexible Shaft Co., 1154 S. Central Ave., Chicago, Ill.  
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Ideal Commutator Dresser Co., 1011 Park Ave., Sycamore, Ill.

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Keuffel & Esser Co., Hoboken, N. J.  
Wickes Bros., Saginaw, Mich.

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## BOILER TUBES

Keuffel & Esser Co., Hoboken, N. J.  
National Tube Co., Pittsburgh.  
Ryerson & Son, Joseph T., 2558 W. 16th St., Chicago.

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Acme Machinery Co., Cleveland.  
Ajax Mfg. Co., Cleveland.  
Landis Mch. Co., Inc., Waynesboro, Pa.  
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National Mch. Co., Tiffin, Ohio.  
Teer, Wickwire & Co., Jackson, Mich.  
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National Acme Co., Cleveland, O.

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Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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Barnes Drill Co., 814 Chestnut St., Rockford, Ill.  
Barnes, W. F. & John, Co., 231 Ruby St., Rockford, Ill.  
Buhr Machine Tool Co., Ann Arbor, Mich.  
Bullard Mch. Tool Co., Bridgeport, Ct.  
Consolidated Machine Tool Corp., Rochester, N. Y.  
Ferner, R. Y., Co., Washington, D. C.  
Foot-Burt Co., Cleveland.  
Gisholt Machine Co., 1300 E. Washington Ave., Madison, Wis.  
Gorton, Geo., Mch. Co., Racine, Wis.  
Ingersoll Milling Mch. Co., Rockford, Ill.  
Moline Tool Co., Moline, Ill.  
Niles-Bement-Pond Co., 111 Broadway, New York.  
Rockford Drilling Machine Co., Rockford, Illinois.  
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Cincinnati Planer Co., Cincinnati.  
Consolidated Machine Tool Corp., Rochester, N. Y.  
Gisholt Machine Co., 1300 E. Washington Ave., Madison, Wis.  
Niles-Bement-Pond Co., 111 Broadway, New York.  
Sellers & Co., Inc., Wm., Philadelphia.

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American Hollow Boring Co., Erie, Pa.  
Armstrong Bros. Tool Co., 313 No. Francisco Ave., Chicago.  
Bullard Mch. Tool Co., Bridgeport, Ct.  
Davis Boring Tool Co., Inc., 6200 Maple Ave., St. Louis, Mo.  
Gisholt Machine Co., 1300 E. Washington Ave., Madison, Wis.  
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill.  
Lovejoy Tool Co., Inc., Springfield, Vt.  
Madison Mfg. Co., Muskegon, Mich.  
Pedrick Tool & Mch. Co., 3639 N. Lawrence St., Philadelphia.  
Ready Tool Co., Bridgeport, Conn.  
Underwood Corp., H. B., Philadelphia.  
Williams, J. H., & Co., Buffalo, N. Y.

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Buhr Machine Tool Co., Ann Arbor, Mich.  
Consolidated Machine Tool Corp., of America, Rochester, N. Y.  
Defiance Machine Co., Defiance, Ohio.  
Giddings & Lewis Mch. Tool Co., Fond-du-Lac, Wis.  
Hofer Mfg. Co., Freeport, Ill.  
Ingersoll Milling Mch. Co., Rockford, Ill.  
Jones Mch. Tool Wks., Inc., Phila., Pa.  
Landis Tool Co., Waynesboro, Pa.  
Lucas Mch. Tool Co., Cleveland.  
Manning, Maxwell & Moore, Inc., 100 East 42nd Street, New York.  
Niles-Bement-Pond Co., 111 Broadway, New York.  
Pedrick Tool & Mch. Co., 3639 N. Lawrence St., Philadelphia.  
Rockford Drilling Machine Co., Rockford, Ill.  
Ryerson & Son, Joseph T., 2558 W. 16th St., Chicago, Ill.  
Sellers & Co., Inc., Wm., Philadelphia.  
Shaw Crane-Putnam Mch. Co., Inc., (Putnam Wks.), Fitchburg, Mass.  
Universal Boring Mch. Co., Hudson, Mass.

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Casler, Herman, Canastota, N. Y.  
Gairing Tool Co., Inc., Detroit.  
Porter-Cable Machine Co., Syracuse, N. Y.  
Rickert-Shafer Co., Erie, Pa.  
Waterston, J. M., 425 Woodward Ave., Detroit, Mich.

## BORING TOOLS

American Hollow Boring Co., Erie, Pa.  
Armstrong Bros. Tool Co., 313 North Francisco Ave., Chicago.  
Davis Boring Tool Co., Inc., 6200 Maple Ave., St. Louis, Mo.  
Gairing Tool Co., Inc., Detroit.  
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill.  
Lovejoy Tool Co., Inc., Springfield, Vt.  
Morse Twist Drill & Mch. Co., New Bedford, Mass.  
O. K. Tool Co., Inc., Shelton, Conn.  
Ready Tool Co., Bridgeport, Conn.  
Williams, J. H., & Co., Buffalo, N. Y.

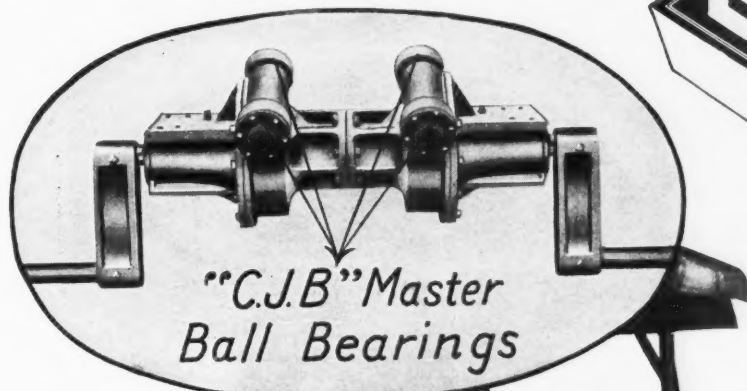
## BRAKES, PRESS AND BENDING

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ALPHABETICAL INDEX OF ADVERTISERS, PAGES 309-310

# Ask the Rear Axle of This Shawnee

The SHAWNEE Cletrac Powered Grader has a rear crank axle, enabling the grading blade to be adjusted by raising or lowering either side of the frame. "C. J. B." Master Ball Bearings assure smooth, dependable operation.



The view in the oval shows the location of the four "C. J. B." Quality Ball Bearings which insure the long life of this special axle construction.



THE unerring high quality of "C. J. B." Master Ball Bearings is finding its way, more and more, into the machinery of every industry—to the mutual advantage of user and manufacturer. The user gains service—the manufacturer, reputation.

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**BROACHING MACHINES**

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Lapointe Machine Tool Co., Hudson, Mass.  
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Cincinnati Electrical Tool Co., Cincinnati.  
Cisco Machine Tool Co., Cincinnati, O.  
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.  
Hill-Curtis Co., 1406 N. Pitcher St., Kalamazoo, Mich.  
New Britain Mch. Co., New Britain, Ct.  
Standard Electrical Tool Co., 1936 W. 8th St., Cincinnati, Ohio.  
Stow Mfg. Co., Binghamton, N. Y.  
United States Electrical Tool Co., Cincinnati, O.

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Starrett Co., L. S., Athol, Mass.

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Meisel Press Mfg. Co., 948 Dorchester Ave., Boston, Mass.  
Pittsburgh Gear & Mch. Co., 2700 Smallman St., Pittsburgh.  
Williams, J. H., & Co., Buffalo, N. Y.

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**CASE-HARDENING FURNACES**

See Furnaces, Case-hardening.

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Aluminum Co. of America, 2437 Oliver Bldg., Pittsburgh, Pa.

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Aluminum Co. of America, 2437 Oliver Bldg., Pittsburgh, Pa.  
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Franklin Die Casting Corp., Syracuse, N. Y.  
McGill Metal Co., Valparaiso, Ind.  
Republic Die Casting Co., Inc., 128 E. Mott St., New York.  
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Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.  
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Hendey Mch. Co., Torrington, Conn.  
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Pratt & Whitney Co., Hartford, Conn.  
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See Hoists, Chain, etc.

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Link-Belt Company, Chicago.  
Morse Chain Co., Ithaca, N. Y.  
Philadelphia Gear Works, Philadelphia.  
Ramsey Chain Co., Inc., Albany, N. Y.  
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Cleveland Auto Mch. Co., Cleveland.  
Gisholt Machine Co., 1300 E. Washington Ave., Madison, Wis.

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National Acme Co., Cleveland, O.  
New Britain Mch. Co., New Britain, Ct.  
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Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill.  
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Logansport Machine Co., 529 Market St., Logansport, Ind.  
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Whitney Mfg. Co., Hartford, Conn.

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National Twist Drill & Tool Co., Detroit, Mich.

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Union Mfg. Co., New Britain, Conn.

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Rivett Lathe & Grinder Corp., Brighton District, Boston.

Ryerson & Son, Joseph T., 2558 W. 16th St., Chicago.

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National Tool Co., Cleveland.

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Whitney Mfg. Co., Hartford, Conn.

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Graham Mfg. Co., Providence, R. I.

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McCrosky Tool Corp., Meadville, Pa.

Modern Tool Works, (Consolidated Mch. Tool Corp.) Rochester, N. Y.

Procurrier Safety Chuck Co., 18 S. Clinton St., Chicago.

**Scully-Jones & Co., 13th and Roby Sts., Chicago.**

Watts Bros. Tool Wks., Wilmerding, Pa.  
Whitney Mfg. Co., Hartford, Conn.

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Armstrong Bros. Tool Co., 313 North Francisco Ave., Chicago.  
Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.  
Danly Machine Specialties, Inc., 2112 S. 52nd Ave., Chicago.  
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Williams, J. H., & Co., Buffalo, N. Y.

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Foots Bros. Gear & Mch. Co., 232-242 W. Curtis St., Chicago.

Hilliard Clutch Corp., Elmira, N. Y.

Johnson Machine Co., Carlyle, Manchester, Conn.

Jones Foundry & Machine Co., W. A., 4409 W. Roosevelt Rd., Chicago.

Link-Belt Company, Chicago.

Medart Co., St. Louis, Mo.

Moore & White Co., 2707-2737 No. 15th St., Philadelphia.

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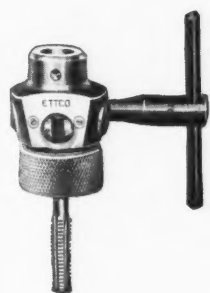
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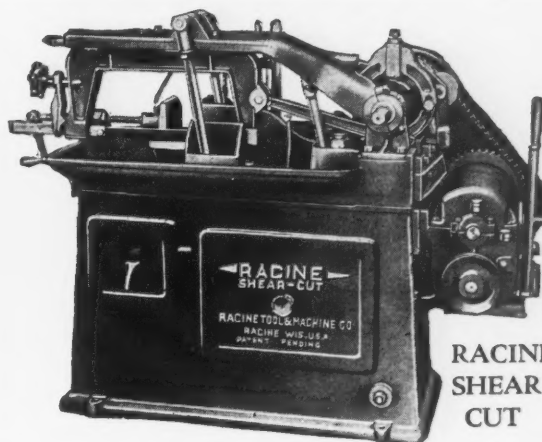
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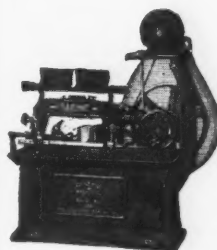
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Knight, W. B., Mch. Co., St. Louis, Mo.  
Moline Tool Co., Moline, Ill.

**DRILLING MACHINES, AUTOMATIC**

Avey Drilling Machine Co., Cincinnati.  
Baker Bros., Inc., Toledo, Ohio.  
Barnes Co., W. F. & John, Rockford, Ill.  
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.  
Buhr Machine Tool Co., Ann Arbor, Mich.  
Cincinnati Automatic Mch. Co., Cincinnati.  
Grant Mfg. & Mch. Co., N. W. Station, Bridgeport, Conn.  
Hoefler Mfg. Co., Freeport, Ill.  
Kingsbury Mch. Tool Corp., Keene, N.H.  
Millholland Sales & Engineering Co., Indianapolis, Ind.  
National Automatic Tool Co., Richmond, Ind.

**DRILLING MACHINES, BENCH**

Ames, B. C. Co., Waltham, Mass.  
Avey Drilling Machine Co., Cincinnati.  
Barnes Co., W. F. & John, 231 Ruby St., Rockford, Ill.  
Buffalo Forge Co., Buffalo, N. Y.  
Burke Mch. Tool Co., 516 Sandusky St., Conneaut, Ohio.  
Canedy-Otto Mfg. Co., Chicago Heights, Ill.  
Cincinnati Electrical Tool Co., Cincinnati.  
High Speed Hammer Co., Inc., Rochester, N. Y.  
Kingsbury Mch. Tool Corp., Keene, N.H.  
Langelier Mfg. Co., Arlington, Cranston, R. I.  
LeBlond, R. K., Machine Tool Co., Cincinnati.  
Leland-Gifford Co., Worcester, Mass.  
Millholland Sales & Engineering Co., Indianapolis, Ind.  
National Automatic Tool Co., Richmond, Ind.  
Rockford Drilling Machine Co., Rockford, Ill.  
Sigourney Tool Co., 11 Sigourney St., Hartford, Conn.  
Standard Electrical Tool Co., 1936 W. 8th St., Cincinnati, Ohio.  
United States Electrical Tool Co., Cincinnati, O.  
Wisconsin Electric Co., Racine, Wis.

**DRILLING MACHINES, BOILER**

Cincinnati-Bickford Tool Co., Oakley, Cincinnati.  
Foote-Burt Co., Cleveland.  
Niles-Bement-Pond Co., 111 Broadway, New York.  
Sellers & Co., Inc., Wm., Philadelphia.

**DRILLING MACHINES, GANG**

Avey Drilling Machine Co., Cincinnati.  
Baker Bros., Inc., Toledo, O.  
Barnes Co., W. F. & John, 231 Ruby St., Rockford, Ill.  
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.  
Cincinnati-Bickford Tool Co., Oakley, Cincinnati.  
Consolidated Machine Tool Corp., Rochester, N. Y.  
Foote-Burt Co., Cleveland.  
Fosdick Mch. Tool Co., Cincinnati.  
Hoefler Mfg. Co., Freeport, Ill.  
Ingersoll Milling Machine Co., Rockford, Ill.  
Kingsbury Mch. Tool Corp., Keene, N.H.  
Leland-Gifford Co., Worcester, Mass.  
Langelier Mfg. Co., Arlington, Cranston, R. I.  
Millholland Sales & Engineering Co., Indianapolis, Ind.  
Moline Tool Co., Moline, Ill.  
Niles-Bement-Pond Co., 111 Broadway, New York.  
Oesterlein Mch. Co., Cincinnati, O.  
Rockford Drilling Mch. Co., Rockford, Ill.  
Rockford Mch. Tool Co., 2400 Kishwaukee Rd., Rockford, Ill.  
Sigourney Tool Co., 11 Sigourney St., Hartford, Conn.

**DRILLING MACHINES, HORIZONTAL, DUPLEX**

Avey Drilling Machine Co., Cincinnati.  
Barnes, W. F. & John, Co., 231 Ruby St., Rockford, Ill.  
Buhr Machine Tool Co., Ann Arbor, Mich.  
Consolidated Machine Tool Corporation of America, Rochester, N. Y.  
Frew Machine Co., Philadelphia.  
Kingsbury Mch. Tool Corp., Keene, N.H.  
Langelier Mfg. Co., Arlington, Cranston, R. I.  
Millholland Sales & Engineering Co., Indianapolis, Ind.  
Murchey Mch. & Tool Co., 34 Porter St., Detroit, Mich.  
Rockford Drilling Machine Co., Rockford, Ill.

**DRILLING MACHINES, MULTIPLE SPINDLE, HORIZONTAL**

Buhr Machine Tool Co., Ann Arbor, Mich.  
Consolidated Machine Tool Corp., Rochester, N. Y.  
Greenlee Bros. & Co., Rockford, Ill.  
Hoefler Mfg. Co., Freeport, Ill.  
Ingersoll Milling Mch. Co., Rockford, Ill.  
Kingsbury Mch. Tool Corp., Keene, N.H.  
Langelier Mfg. Co., Arlington, Cranston, R. I.  
Millholland Sales & Engineering Co., Indianapolis, Ind.  
Moline Tool Co., Moline, Ill.  
National Automatic Tool Co., Richmond, Ind.  
United States Drill Head Co., 1948 W. 6th St., Cincinnati.

**DRILLING MACHINES, MULTIPLE SPINDLE, TURRET**

Kingsbury Mch. Tool Corp., Keene, N.H.  
Langelier Mfg. Co., Arlington, Cranston, R. I.

**DRILLING MACHINES, MULTIPLE SPINDLE, VERTICAL**

Avey Drilling Mch. Co., Cincinnati.  
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Barnes Co., W. F. & John, 231 Ruby St., Rockford, Ill.  
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.  
Buhr Machine Tool Co., Ann Arbor, Mich.  
Cincinnati-Bickford Tool Co., Oakley, Cincinnati.  
Consolidated Machine Tool Corp., Rochester, N. Y.  
Foote-Burt Co., Cleveland.  
Greenlee Bros. & Co., Rockford, Ill.  
Hoefler Mfg. Co., Freeport, Ill.  
Ingersoll Milling Mch. Co., Rockford, Ill.  
Kingsbury Mch. Tool Corp., Keene, N.H.  
Langelier Mfg. Co., Arlington, Cranston, R. I.  
Leland-Gifford Co., Worcester, Mass.  
Millholland Sales & Engineering Co., Indianapolis, Ind.  
Moline Tool Co., Moline, Ill.  
National Automatic Tool Co., Richmond, Ind.  
Niles-Bement-Pond Co., 111 Broadway, New York.  
Pratt & Whitney Co., Hartford, Conn.  
Rockford Drilling Mch. Co., Rockford, Ill.  
Rockford Mch. Tool Co., 2400 Kishwaukee Rd., Rockford, Ill.  
Sellers & Co., Inc., Wm., Philadelphia.  
United States Drill Head Co., 1948 W. 6th St., Cincinnati.

**DRILLING MACHINES, RADIAL**

American Tool Works Co., Cincinnati.  
Barnes Co., W. F. & John, 31 Ruby St., Rockford, Ill.  
Canedy-Otto Mfg. Co., Chicago Heights, Ill.  
Caton Machine Tool Co., Cincinnati, Ohio.  
Cincinnati-Bickford Tool Co., Oakley, Cincinnati.

Cincinnati Electrical Tool Co., Cincinnati.  
Cisco Machine Tool Co., Cincinnati, O.  
Drees Machine Tool Co., Cincinnati.  
Fosdick Machine Tool Co., Cincinnati.  
Giddings & Lewis Mch. Tool Co., Fond-du-Lac, Wis.  
Morris Machine Tool Co., Cincinnati.  
Niles-Bement-Pond Co., 111 Broadway, New York.  
Reed-Prentice Corp., Worcester, Mass.  
Ryerson & Son, Joseph T., 2555 W. 16th St., Chicago.  
Sellers & Co., Inc., Wm., Philadelphia.  
Western Mch. Tool Works, Holland, Mich.

**DRILLING MACHINES, RAIL**

Baker Bros., Inc., Toledo, O.  
Consolidated Machine Tool Corp., Rochester, N. Y.  
Defiance Machine Co., Defiance, O.  
Foote-Burt Co., Cleveland.  
General Electric Co., Schenectady, N.Y.  
Moline Tool Co., Moline, Ill.  
Niles-Bement-Pond Co., 111 Broadway, New York.  
Sellers & Co., Inc., Wm., Philadelphia.

**DRILLING MACHINES, SENSITIVE**

Avey Drilling Mch. Co., Cincinnati.  
Barnes Co., W. F. & John, 231 Ruby St., Rockford, Ill.  
Burke Mch. Tool Co., 516 Sandusky St., Conneaut, Ohio.  
Canedy-Otto Mfg. Co., Chicago Heights, Ill.  
Foote-Burt Co., Cleveland.  
Fosdick Mch. Tool Co., Cincinnati.  
High Speed Hammer Co., Inc., Rochester, N. Y.  
Kingsbury Mch. Tool Corp., Keene, N.H.  
Langelier Mfg. Co., Arlington, Cranston, R. I.  
Leland-Gifford Co., Worcester, Mass.  
Manufacturers' Consulting Engineers, Syracuse, N. Y.  
Pratt & Whitney Co., Hartford, Conn.  
Rockford Drilling Machine Co., Rockford, Ill.  
Rockford Mch. Tool Co., 2400 Kishwaukee Rd., Rockford, Ill.  
Roryersford Fdry. & Machine Co., Box M., Roryersford, Pa.  
Sibley Machine Co., 8 Tutt St., South Bend, Ind.  
Sigourney Tool Co., 11 Sigourney St., Hartford, Conn.  
Townsend, H. P., Mfg. Co., Hartford, Conn.  
United States Machine Tool Co., Cincinnati.

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Baker Bros., Inc., Toledo, O.  
Barnes Co., W. F. & John, 231 Ruby St., Rockford, Ill.  
Buffalo Forge Co., Buffalo, N. Y.  
Canedy-Otto Mfg. Co., Chicago Heights, Ill.  
Cincinnati-Bickford Tool Co., Oakley, Cincinnati.  
Consolidated Machine Tool Corp., Rochester, N. Y.  
Foote-Burt Co., Cleveland.  
Fosdick Mch. Tool Co., Cincinnati.  
Harrington Co., Philadelphia, Pa.  
Hoefler Mfg. Co., Freeport, Ill.  
Ingersoll Milling Machine Co., Rockford, Ill.  
Kingsbury Mch. Tool Corp., Keene, N.H.  
Langelier Mfg. Co., Arlington, Cranston, R. I.  
Leland-Gifford Co., Worcester, Mass.  
Millholland Sales & Engineering Co., Indianapolis, Ind.  
Minster Mch. Co., Minster, Ohio.  
Moline Tool Co., Moline, Ill.  
Niles-Bement-Pond Co., 111 Broadway, New York.  
Oesterlein Mch. Co., Cincinnati, O.  
Rockford Drilling Machine Co., Rockford, Ill.

**DRILLING MACHINES, WALL RADIAL**

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Consolidated Machine Tool Corporation of America, Rochester, N. Y.  
Hanna Engineering Works, 1763 Elston Ave., Chicago.  
Wickes Bros., Saginaw, Mich.

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Cogsdill Mfg. Co., Detroit.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Morse Twist Drill & Mch. Co., New Bedford, Mass.  
National Twist Drill & Tool Co., Detroit.  
Pratt & Whitney Co., Hartford, Conn.  
Slocum, J. T., Providence, R. I.  
Standard Tool Co., Cleveland.

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Morse Twist Drill & Mch. Co., New Bedford, Mass.

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Black & Decker Mfg. Co., Baltimore, Md.  
Cincinnati Electrical Tool Co., Cincinnati.  
Errington Mechanical Laboratory, Broadway and John St., New York.

Haskins, R. G. Co., 4634 Fulton St., Chicago.  
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago.  
Millers Falls Co., Millers Falls, Mass.  
Standard Electrical Tool Co., 1936 W. 8th St., Cincinnati, Ohio.  
Stow Mfg. Co., Binghamton, N. Y.  
U. S. Electrical Tool Co., Cincinnati, Ohio.  
Wisconsin Electric Co., Racine, Wis.

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Ingersoll-Rand Co., 11 Broadway, New York.

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Cleveland Twist Drill Co., Cleveland.  
Greene, Tweed & Co., 109 Duane St., New York.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Morse Twist Drill & Mch. Co., New Bedford, Mass.  
National Twist Drill & Tool Co., Detroit.  
Pratt & Whitney Co., Hartford, Conn.  
Standard Tool Co., Cleveland.

**DRILLS, SQUARE AND HEXAGON**

Watts Bros. Tool Works, Wilmerding, Pa.

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Cleveland Twist Drill Co., Cleveland.  
Colton, Arthur, Co., 2618 Jefferson Ave., E. Detroit, Mich.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Morse Twist Drill & Mch. Co., New Bedford, Mass.  
National Twist Drill & Tool Co., Detroit.  
Pratt & Whitney Co., Hartford, Conn.  
Standard Tool Co., Cleveland.  
Union Twist Drill Co., Athol, Mass.

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Watson-Stillman Co., 73 West St., New York City.

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**FERRO TUNGSTEN**

Vanadium-Alloys Steel Co., Latrobe, Pa.

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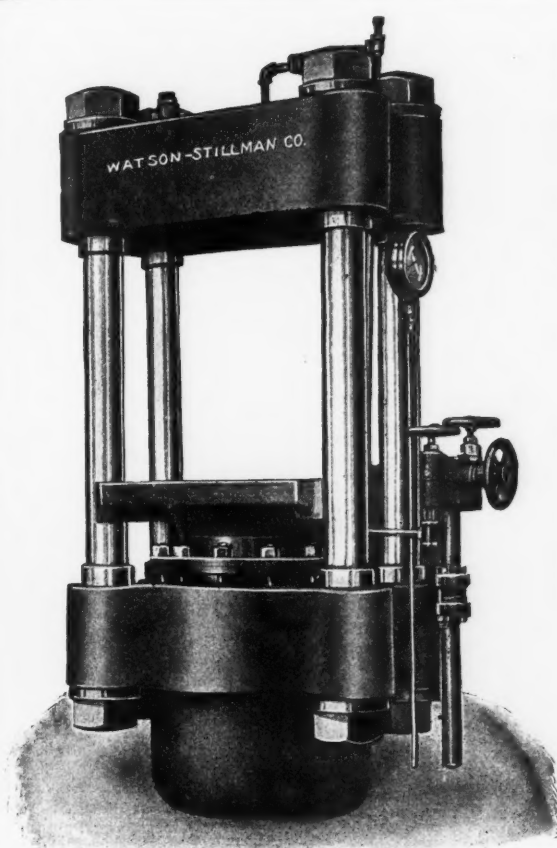
Osgood Tool Co., J. L., Buffalo, N. Y.  
Rockford Mch. Tool Co., 2400 Kishwaukee Rd., Rockford, Ill.  
Ryerson & Son, Joseph T., 2555 W. 16th St., Chicago, Ill.  
Sellers, Wm., & Co., Inc., Philadelphia.  
Sibley Machine Co., 8 Tutt St., South Bend, Ind.  
Sigourney Tool Co., 11 Sigourney St., Hartford, Conn.  
United States Machine Tool Co., Cincinnati.

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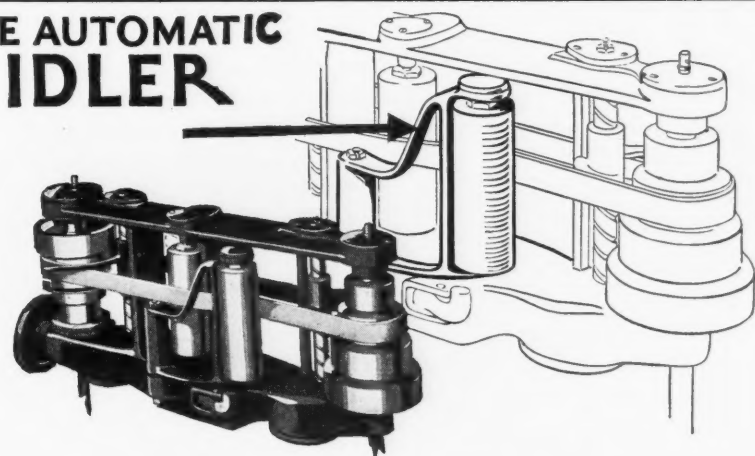


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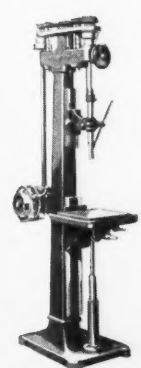
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 New York.  
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 Zernickow, O. Co., 21 Park Row,  
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 Scherr, Geo., Co., 144 Liberty St.,  
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 Comtor Co., Waltham, Mass.  
 Ferner, R. Y., Co., Washington, D. C.  
 Greenfield Tap & Die Corp., Greenfield,  
 Mass.  
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 Mass.  
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Meisselbach-Catucci Mfg. Co., Newark,  
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SPIRAL BEVEL**

Gleason Works, Rochester, N. Y.

**GEAR CUTTING MACHINES, SPUR  
AND BEVEL (ROTARY CUTTER)**

Brown & Sharpe Mfg. Co., Providence.  
 Gould & Eberhardt, Newark, N. J.  
 Newark Gear Cutting Mch. Co., New-  
 ark, N. J.  
 Waltham Mch. Works, Waltham, Mass.  
 Whiton Machine Co., D. E., New Lon-  
 don, Conn.

**GEAR CUTTING MACHINES,  
WORMS AND WORM WHEELS  
(HOB)**

Adams Co., Dubuque, Iowa.  
 Barber-Colman Co., Rockford, Ill.  
 Gould & Eberhardt, Newark, N. J.  
 Lees-Bradner Co., Cleveland, Ohio.  
 Meisselbach-Catucci Mfg. Co., Newark,  
 N. J.  
 Newark Gear Cutting Mch. Co., New-  
 ark, N. J.  
 Pfauter, Herman, Works, 21 Park Row,  
 New York.  
 Scherr, Geo., Co., 144 Liberty St., N. Y.  
 Zernickow, O. Co., 21 Park Row,  
 New York.

**GEAR HARDENING MACHINES**

Gleason Works, Rochester, N. Y.

**GEAR TESTING MACHINERY**

Adams Co., Dubuque, Iowa.  
 Brown & Sharpe Mfg. Co., Providence,  
 R. I.  
 Farrel-Birmingham Co., Inc., Buffalo,  
 N. Y.  
 Ferner, R. Y., Co., Washington, D. C.  
 Gleason Works, Rochester, N. Y.  
 Lees-Bradner Co., Cleveland, Ohio.  
 Manufacturers' Consulting Engineers,  
 Syracuse, N. Y.  
 Morse Twist Drill & Mch. Co., New  
 Bedford, Mass.  
 National Tool Co., Cleveland.  
 Scherr, Geo., Co., 144 Liberty St.,  
 New York City.

**GEARS, CUT**

Adams Co., Dubuque, Iowa.  
 Bilgram Machine Works, 1231 Spring  
 Garden St., Philadelphia.  
 Boston Gear Wks. Sales Co., Norfolk  
 Downs, Quincy, Mass.  
 Brown Co., A. & F., 79 Barclay St.,  
 New York.  
 Brown & Sharpe Mfg. Co., Providence.  
 Chicago Rawhide Mfg. Co., 1279 Elston  
 Ave., Chicago.  
 Cincinnati Gear Co., Cincinnati.  
 Crofoot, Chas. E. Gear Corp., 65 Cen-  
 tral Ave., South Easton, Mass.  
 Cullman Wheel Co., 1329 Altgeld St.,  
 Chicago.

Davis, Rodney, Philadelphia.  
 Diefendorf Gear Corp., Syracuse, N. Y.  
 Earle Gear & Mfg. Co., Philadelphia.  
 Farrel-Birmingham Co., Buffalo, N. Y.  
 Fellows Gear Shaper Co., Springfield,  
 Conn.

Ferguson Gear Co., Gastonia, N. C.  
 Flexible Engineering Corp., 10 East  
 43rd St., New York.

Foots Bros. Gear & Mch. Co., 232-242  
 N. Curtis St., Chicago.  
 Gears & Forgings, Inc., 3122 Woodhill  
 Rd., Cleveland.

General Electric Co., Schenectady, N.Y.  
 Gleason Works, Rochester, N. Y.  
 Grant Gear Works, Inc., Boston.  
 Harrington Co., Philadelphia, Pa.  
 Hartford Special Mch. Co., Hartford,  
 Conn.

Hindley Gear Co., Philadelphia.  
 Horsburgh & Scott Co., Cleveland.  
 Jones Foundry & Mch. Co., W. A.,  
 4409 W. Roosevelt Rd., Chicago.

Lees-Bradner Co., Cleveland, Ohio.  
 Link-Belt Company, Chicago.  
 Machine Products Co., Cleveland.  
 Massachusetts Gear & Tool Co., 34  
 Nashua St., Woburn, Mass.

Medart Co., St. Louis, Mo.  
 Meisselbach-Catucci Mfg. Co., Newark,  
 N. J.  
 Newark Gear Cutting Machine Co.,  
 Newark, N. J.

Niles-Bement-Pond Co., 111 Broadway,  
 New York.  
 Nuttall, R. D. Co., Pittsburgh, Pa.  
 Philadelphia Gear Works, Philadelphia.  
 Pittsburgh Gear & Mch. Co., 2700  
 Smallman St., Pittsburgh.

Scherr, Geo., Co., 144 Liberty St.,  
 New York City.  
 Simonds Mfg. Co., Pittsburgh.  
 Smith, Winfield H., Springfield, N. Y.  
 Stahl Gear & Mch. Co., Cleveland.  
 Toledo Mch. & Tool Co., Toledo.  
 Westinghouse Electric & Mfg. Co., East  
 Pittsburgh, Pa.

**GEARS, FORGED**

Gears & Forgings, Inc., 3122 Woodhill  
 Road, Cleveland, O.  
 Nuttall, R. D. Co., Pittsburgh, Pa.

**GEARS, MOLDED**

American Manganese Steel Co., 1850  
 McCormick Bldg., Chicago.  
 Brown Co., A. & F., 79 Barclay St.,  
 New York.  
 Foots Bros. Gear & Mch. Co., 232-242  
 N. Curtis St., Chicago.  
 Franklin Die Casting Corp., Syracuse,  
 N. Y.  
 Gunite Corporation, Rockford, Ill.  
 Horsburgh & Scott Co., Cleveland, O.  
 Jones Fdry. & Mch. Co., W. A., 4409  
 W. Roosevelt Rd., Chicago.  
 Link-Belt Company, Chicago.  
 Medart Co., St. Louis, Mo.  
 Philadelphia Gear Works, Philadelphia.  
 Simonds Mfg. Co., Pittsburgh.  
 Stahl Gear & Mch. Co., Cleveland.  
 Westinghouse Electric & Mfg. Co., East  
 Pittsburgh, Pa.

**GEARS, RAWHIDE AND NON-  
METALLIC**

Boston Gear Wks. Sales Co., Norfolk  
 Downs, Quincy, Mass.  
 Brown Co., A. & F., 79 Barclay St.,  
 New York.  
 Chicago Rawhide Mfg. Co., 1309 Elston  
 Ave., Chicago.  
 Cincinnati Gear Co., Cincinnati.  
 Diefendorf Gear Corp., Syracuse, N. Y.  
 Earle Gear & Mch. Co., Philadelphia.  
 Federal Gear, Inc., Cleveland, Ohio.  
 Ferguson Gear Co., Gastonia, N. C.  
 Fibroc Insulation Co., 1023 Lincoln  
 Ave., Valparaiso, Ind.  
 Foots Bros. Gear & Mch. Co., 232-242  
 N. Curtis St., Chicago.  
 Gears & Forgings, Inc., 3122 Woodhill  
 Road, Cleveland, O.  
 General Electric Co., Schenectady, N.Y.  
 Grant Gear Works, Inc., Boston.  
 Hartford Special Mch. Co., Hartford,  
 Conn.  
 Horsburgh & Scott Co., Cleveland.  
 Massachusetts Gear & Tool Co., Wo-  
 burn, Mass.  
 Medart Co., St. Louis, Mo.  
 Meisselbach-Catucci Mfg. Co., 948 Dorchester  
 Ave., Boston, Mass.  
 Newark Gear Cutting Machine Co.,  
 Newark, N. J.  
 Nuttall, R. D. Co., Pittsburgh, Pa.  
 Philadelphia Gear Works, Philadelphia.  
 Pittsburgh Gear & Mch. Co., 2700  
 Smallman St., Pittsburgh.  
 Simonds Mfg. Co., Pittsburgh.  
 Stahl Gear & Mch. Co., Cleveland.  
 Westinghouse Electric & Mfg. Co., East  
 Pittsburgh, Pa.

**GEARS, SILENT METAL**

Flexible Engineering Corp., 10 East  
 43rd St., New York.

**GENERATORS, ELECTRIC**

General Electric Co., Schenectady, N.Y.  
 Lincoln Electric Co., Cleveland, Ohio.  
 Westinghouse Electric & Mfg. Co., East  
 Pittsburgh, Pa.

**GENERATORS, GAS**

American Gas Furnace Co., Elizabeth,  
 N. J.

**GLUE HEATERS**

General Electric Co., Schenectady, N.Y.

**GRADUATING MACHINES**

Ferner, R. Y., Co., Washington, D. C.  
 Noble & Westbrook Mfg. Co., Hartford,  
 Conn.

**GREASE CUPS**

Brown Products Corp., Auburn, N. Y.  
 Cincinnati Ball Crank Co., Cincinnati.  
 Link-Belt Company, Chicago.

**GRINDERS, PNEUMATIC**

Ingersoll-Rand Co., 11 Broadway, New  
 York.

**GRINDERS, PORTABLE ELECTRIC**

See under Grinding Machines, Portable  
 and Toolpost.

**GRINDERS, PNEUMATIC**

Independent Pneumatic Tool Co., 600  
 W. Jackson Blvd., Chicago.

**GRINDING MACHINES,  
ABRASIVE BELT**

Costa Machine Tool Co., 112 W. 40th  
 St., New York City.  
 Porter-Cable Machine Co., Syracuse,  
 N. Y.  
 Production Machine Co., Greenfield,  
 Mass.  
 Walls Sales Corp., 96 Warren St., New  
 York.

**GRINDING MACHINES, BENCH**

Blount, J. G. Co., Everett, Mass.  
 Bridgeport Safety Emery Wheel Co.,  
 Inc., 1283 W. Broad St., Bridge-  
 port, Conn.  
 Cincinnati Electrical Tool Co., Cin-  
 cinnati.  
 Diamond Machine Co., Providence, R.I.  
 Gallmeyer & Livingston Co., 344  
 Straight Ave., S. W., Grand Rapids,  
 Mich.  
 Hardinge Bros., Inc., 4149 Ravenswood  
 Ave., Chicago.  
 Hill-Curtis Co., 1406 N. Pitcher St.,  
 Kalamazoo, Mich.  
 New Britain Mch. Co., New Britain, Ct.

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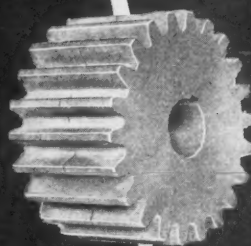
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Rivett Lathe & Grinder Corp., Brighton, Boston.  
 Ryerson & Sons, Joseph T., 2558 W. 16th St., Chicago, Ill.  
 Standard Electrical Tool Co., 1936 W. 8th St., Cincinnati, Ohio.  
 Sterling Grinding Wheel Co., Tiffin, O.  
 United States Electrical Tool Co., Cincinnati, O.  
 Walker Co., Inc., O. S., Worcester, Mass.

**GRINDING MACHINES, CENTER**  
 Cincinnati Electrical Tool Co., Cincinnati.  
 Diamond Machine Co., Providence, R. I.  
 U. S. Electrical Tool Co., Cincinnati.

**GRINDING MACHINES, CENTERLESS**  
 Cincinnati Grinders, Inc., Cincinnati.

**GRINDING MACHINES, CHASER OR DIE**  
 Consolidated Machine Tool Corporation of America, Rochester, N. Y.  
 Geometric Tool Co., New Haven, Conn.  
 Landis Mch. Co., Inc., Waynesboro, Pa.  
 National Machinery Co., Tiffin, Ohio.

**GRINDING MACHINES, CHUCKING**  
 Bryant Chucking Grinder Co., Springfield, Vt.

**GRINDING MACHINES, CUTTER**  
 See heading, Grinding Machines, Tool and Cutter.

**GRINDING MACHINES, CYLINDER**  
 Foster Machine Co., Elkhart, Ind.  
 Heald Machine Co., 16 New Bond St., Worcester, Mass.

**GRINDING MACHINES, CYLINDRICAL, PLAIN**  
 Brown & Sharpe Mfg. Co., Providence, Cincinnati Grinders, Inc., Cincinnati.  
 Consolidated Machine Tool Corp., Rochester, N. Y.  
 Fitchburg Grinding Mch. Corp., Fitchburg, Mass.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 Landis Tool Co., Waynesboro, Pa.  
 Modern Tool Co., Erie, Pa.  
 Morse Twist Drill & Mch. Co., New Bedford, Mass.  
 Norton Co., Worcester, Mass.  
 Pratt & Whitney Co., Hartford, Conn.

**GRINDING MACHINES, CYLINDRICAL, UNIVERSAL**  
 Brown & Sharpe Mfg. Co., Providence, Cincinnati Grinders, Inc., Cincinnati.  
 Consolidated Machine Tool Corp., Rochester, N. Y.  
 Fitchburg Grinding Mch. Corp., Fitchburg, Mass.  
 Landis Tool Co., Waynesboro, Pa.  
 Morse Twist Drill & Mch. Co., New Bedford, Mass.  
 Pratt & Whitney Co., Hartford, Conn.  
 Thompson Grinder Co., Springfield, O.

**GRINDING MACHINES, DIE SINKERS, PORTABLE**  
 Biax Flexible Shaft Co., Inc., 20 E. 17th St., New York.  
 Keller Mechanical Engineering Corp., 74 Washington St., Brooklyn, N. Y.

**GRINDING MACHINES, DISC**  
 Badger Tool Co., Beloit, Wis.  
 Besly, Chas. H. & Co., 120-B N. Clinton St., Chicago.  
 Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Conn.  
 Diamond Machine Co., Providence, R. I.  
 Gallmeyer & Livingston Co., 344 Straight Ave., S. W., Grand Rapids, Mich.  
 Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.  
 Porter-Cable Mch. Co., Syracuse, N. Y.  
 Rowbottom Mch. Co., Waterbury, Ct.  
 United States Electrical Tool Co., Cincinnati, O.

**GRINDING MACHINES, DRILL**  
 Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Conn.  
 Gallmeyer & Livingston Co., 344 Straight Ave., S. W., Grand Rapids, Mich.  
 La Salle Tool Co., Ottawa, Ill.  
 Morse Twist Drill & Mch. Co., New Bedford, Mass.  
 Oliver Instrument Co., 1410 E. Main St., Adrian, Mich.  
 Sellers & Co., Inc., Wm., Philadelphia.  
 Union Twist Drill Co., Athol, Mass.

**GRINDING MACHINES, FLOOR STAND TYPE**  
 Blount, J. G., Co., Everett, Mass.  
 Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Conn.  
 Cincinnati Electrical Tool Co., Cincinnati.  
 Cleveland Stone Co., Cleveland.  
 Gallmeyer & Livingston Co., 344 Straight Ave., S. W., Grand Rapids, Mich.  
 Hill-Curtis Co., 1406 N. Pitcher St., Kalamazoo, Mich.  
 Ryerson & Sons, Joseph T., 2558 W. 16th St., Chicago, Ill.  
 Standard Electrical Tool Co., 1936 W. 8th St., Cincinnati, Ohio.  
 Sterling Grinding Wheel Co., Tiffin, O.  
 U. S. Electrical Tool Co., Cincinnati.

**GRINDING MACHINES, GAGE**  
 Ferner, R. Y., Co., Washington, D. C.  
 Scherr, Geo., Co., 144 Liberty St., N. Y.

**GRINDING MACHINES, GEAR TOOTH**  
 Lees-Bradner Co., Cleveland, Ohio.  
 National Tool Co., Cleveland, O.  
 Walcott Machine Co., Jackson, Mich.

**GRINDING MACHINES, HOB**  
 Barber-Colman Co., Rockford, Ill.  
 Pfauter, Herman, Works, 21 Park Row, New York.  
 Scherr, Geo., Co., 144 Liberty St., New York.  
 Union Twist Drill Co., Athol, Mass.  
 Zernickow, O., Co., 21 Park Row, New York City.

**GRINDING MACHINES, INTERNAL**  
 Bryant Chucking Grinder Co., Springfield, Vt.  
 Consolidated Machine Tool Corp., Rochester, N. Y.  
 Giddings & Lewis Mch. Tool Co., Fond-du-Lac, Wis.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 Heald Machine Co., 16 New Bond St., Worcester, Mass.  
 Landis Tool Co., Waynesboro, Pa.  
 Modern Tool Co., Erie, Pa.  
 Rivett Lathe & Grinder Corp., Brighton, Boston.  
 Van Norman Mch. Tool Co., Springfield, Mass.

**GRINDING MACHINES, KNIFE**  
 Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Conn.  
 Diamond Machine Co., Providence, R. I.

**GRINDING MACHINES, MULTIPLE SPINDLE**  
 Bryant Chucking Grinder Co., Springfield, Vt.

**GRINDING MACHINES, PATTERN MAKERS, DISC**  
 Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.

**GRINDING MACHINES, PIPE THREADING DIE**  
 Bignall & Keeler Machine Works, Edwardsville, Ill.  
 Landis Mch. Co., Waynesboro, Pa.  
 National Mch. Co., Tiffin, Ohio.

**GRINDING MACHINES, PISTON RING**  
 Badger Tool Co., Beloit, Wis.  
 Heald Machine Co., 16 New Bond St., Worcester, Mass.  
 Pedrick Tool & Mch. Co., 3639 N. Lawrence St., Philadelphia.

**GRINDING MACHINES, PORTABLE ELECTRIC & TOOLPOST**  
 Biax Flexible Shaft Co., Inc., 20 E. 17th St., New York.  
 Cincinnati Electrical Tool Co., Cincinnati.  
 Haskins, R. G., Co., 4634 Fulton St., Chicago.  
 Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago.  
 Stow Mfg. Co., Binghamton, N. Y.  
 Strand Mfg. Co., N. A., 501 N. Lincoln St., Chicago.  
 U. S. Electrical Tool Co., Cincinnati.  
 Wisconsin Elec. Co., Racine, Wis.

**GRINDING MACHINES, PULLEY**  
 Graham Mfg. Co., Providence, R. I.

**GRINDING MACHINES, RADIAL BALL RACE, ETC.**  
 Rivett Lathe & Grinder Corp., Brighton, Boston.  
 Van Norman Mch. Tool Co., Springfield, Mass.

**GRINDING MACHINES, RING WHEEL**  
 Badger Tool Co., Beloit, Wis.  
 Besly, Chas. H. & Co., 120-B N. Clinton St., Chicago.  
 Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Conn.  
 Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.  
 Graham Mfg. Co., Providence, R. I.

**GRINDING MACHINES, SURFACE**  
 Abrasive Mch. Tool Co., East Providence, R. I.  
 Blanchard Mch. Co., 64 State St., Cambridge, Mass.  
 Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Conn.  
 Brown & Sharpe Mfg. Co., Providence.  
 Consolidated Machine Tool Corp., Rochester, N. Y.  
 Diamond Machine Co., Providence, R. I.  
 Fitchburg Grinding Mch. Corp., Fitchburg, Mass.  
 Gallmeyer & Livingston Co., 344 Straight Ave., S. W., Grand Rapids, Mich.  
 Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.  
 Heald Machine Co., 16 New Bond St., Worcester, Mass.  
 La Salle Tool Co., Ottawa, Ill.  
 Norton Co., Worcester, Mass.  
 Pratt & Whitney Co., Hartford, Conn.  
 Rowbottom Machine Co., Waterbury, Conn.  
 United States Electrical Tool Co., Cincinnati, O.  
 Walker Co., Inc., O. S., Worcester, Mass.

**GRINDING MACHINES, SWING**  
 Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Conn.

Cleveland Stone Co., Cleveland.  
 Gallmeyer & Livingston Co., 344 Straight Ave., S. W., Grand Rapids, Mich.  
 Sterling Grinding Wheel Co., Tiffin, O.

**GRINDING MACHINES, TAP**  
 Ferner, R. Y., Co., Washington, D. C.  
 Gallmeyer & Livingston Co., 344 Straight Ave., S. W., Grand Rapids, Mich.

**GRINDING MACHINES, TOOL AND CUTTER**  
 Armstrong Bros. Tool Co., 313 North Francisco Ave., Chicago.  
 Baird Machine Co., Bridgeport, Conn.  
 Barber-Colman Co., Rockford, Ill.  
 Barnes Co., W. F. & John, 231 Ruby St., Rockford, Ill.  
 Blount, J. G., Co., Everett, Mass.  
 Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Conn.  
 Brown & Sharpe Mfg. Co., Providence.  
 Cincinnati Milling Mch. Co., Cincinnati.  
 Consolidated Machine Tool Corp., Rochester, N. Y.  
 Diamond Machine Co., Providence, R. I.  
 Fafnir Bearing Co., New Britain, Conn.  
 Fitchburg Grinding Mch. Corp., Fitchburg, Mass.  
 Gallmeyer & Livingston Co., 344 Straight Ave., S. W., Grand Rapids, Mich.

Gisholt Machine Co., 1300 E. Washington Ave., Madison, Wis.  
 Gorton, Geo. Mch. Co., Racine, Wis.  
 Gould & Eberhardt, Newark, N. J.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 Ingersoll Milling Machine Co., Rockford, Ill.  
 LeBlond Mch. Tool Co., R. K., Cincinnati.  
 Meisselbach-Catucci Mfg. Co., Newark, N. J.

Modern Tool Co., Erie, Pa.  
 Morse Twist Drill & Mch. Co., New Bedford, Mass.  
 Mummert-Dixon Co., Hanover, Pa.  
 Newark Gear Cutting Machine Co., Newark, N. J.  
 Norton Co., Worcester, Mass.  
 Oesterlein Machine Co., Cincinnati, O.  
 Pratt & Whitney Co., Hartford, Conn.  
 Rogersford Fdry. & Machine Co., Box M, Rogersford, Pa.  
 Sellers & Co., Inc., Wm., Philadelphia.  
 Tabor Mfg. Co., Philadelphia, Pa.  
 Union Twist Drill Co., Athol, Mass.  
 United States Electrical Tool Co., Cincinnati, O.  
 Walker Company, Inc., O. S., Worcester, Mass.  
 Waltham Mch. Wks., Waltham, Mass.  
 Wisconsin Elec. Co., Racine, Wis.

**GRINDING MACHINES, UNIVERSAL**  
 Fitchburg Grinding Mch. Corp., Fitchburg, Mass.  
 Gallmeyer & Livingston Co., 344 Straight Ave., S. W., Grand Rapids, Mich.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 Morse Twist Drill & Mch. Co., New Bedford, Mass.  
 Thompson Grinder Co., Springfield, O.

**GRINDING MACHINES, UNIVERSAL LATHE AND PLANNER TOOLS**  
 Gisholt Machine Co., 1300 E. Washington Ave., Madison, Wis.  
 Sellers & Co., Inc., Wm., Philadelphia.

**GRINDING WHEELS**  
 Abrasive Co., Bridesburg, Philadelphia.  
 Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Conn.  
 Carborundum Co., Niagara Falls, N. Y.  
 Cleveland Stone Co., Cleveland.  
 Norton Co., Worcester, Mass.  
 Sterling Grinding Wheel Co., Tiffin, O.  
 Vittrified Wheel Co., Westfield, Mass.

**GUARDS FOR MACHINERY**  
 Chicago Perforating Co., 2445 West 24th Place, Chicago.  
 New Britain Mch. Co., New Britain, Ct.  
 Taylor-Shantz Co., Rochester, N. Y.  
 Wiesman Mfg. Co., Dayton, O.

**GUARDS FOR PUNCH PRESSES, SAFETY**  
 Taylor-Shantz Co., Rochester, N. Y.  
 Wiesman Mfg. Co., Dayton, O.

**HAMMERS, AIR**  
 Nazel Engineering & Machine Works, 4043 North Fifth St., Philadelphia.

**HAMMERS, DROP**  
 Bliss Co., E. W., Brooklyn, N. Y.  
 Niles-Bement-Pond Co., 111 Broadway, New York.  
 Toledo Mch. & Tool Co., Toledo, O.

**HAMMERS, HELVE**  
 Bradley & Son, Inc., C. C., Syracuse, N. Y.  
 High Speed Hammer Co., Inc., Rochester, N. Y.

**HAMMERS, PNEUMATIC**  
 Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago.  
 Ingersoll-Rand Co., 11 Broadway, New York.

**HAMMERS, POWER**  
 Bradley & Son, Inc., C. C., Syracuse, N. Y.  
 High Speed Hammer Co., Inc., Rochester, N. Y.  
 Nazel Engineering & Machine Works, 4043 North Fifth St., Philadelphia.  
 Ryerson & Sons, Joseph T., 2558 W. 16th St., Chicago.

**HAMMERS, SOFT**  
 Chicago Rawhide Mfg. Co., 1279 Elston Ave., Chicago.

**HAMMERS, STEAM**  
 Niles-Bement-Pond Co., 111 Broadway, New York.  
 Sellers & Co., Inc., Wm., Philadelphia.

**HANGERS, BOX**  
 Shafer Bearing Corp., 6501-99 W. Grand Ave., Chicago.

**HANGERS, SHAFT**  
 American Pulley Co., Philadelphia.  
 Brown Co., A. & F., 79 Barclay St., New York.

Brown & Sharpe Mfg. Co., Providence.  
 Fafnir Bearing Co., New Britain, Conn.  
 Foote Bros. Gear & Mch. Co., 232-242 W. Curtis St., Chicago.  
 Hyatt Roller Bearing Co., Newark, N. J.  
 Link-Belt Company, Chicago.  
 Medart Co., St. Louis, Mo.

New Departure Mfg. Co., Bristol, Conn.  
 Rogersford Fdry. & Machine Co., Box M, Rogersford, Pa.  
 Sellers & Co., Inc., Wm., Philadelphia.  
 S. K. F. Industries, Inc., 40 East 34th St., New York.

Smith, Winfield H., 116 Eaton St., Springfield, N. Y.  
 Standard Pressed Steel Co., Jenkintown, Pa.  
 Wood's, T. B., & Sons Co., Chambersburg, Pa.

**HARDNESS TESTING INSTRUMENTS**  
 Shore Instrument & Mfg. Co., Inc., Jamaica, N. Y.  
 Wilson-Macaulen Co., Inc., 382 Concord Ave., New York.

**HARDNESS TESTING MACHINERY**  
 Olsen, Tinius, Testing Machine Co., Philadelphia.

**HEAT TREATMENT OF STEEL**  
 American Metal Treatment Co., Elizabeth, N. J.  
 Bennett Metal Treating Co., Elmwood, Conn.  
 Machine Products Co., Cleveland.  
 Nuttall, R. D., Co., Pittsburgh, Pa.  
 Pittsburgh Gear & Mch. Co., 2700 Smallman St., Pittsburgh.  
 Williams, White & Co., Moline, Ill.

**HOBBIING MACHINES**  
 See Gear Cutting Machines, Helical and Spur (Hob) and Gear Cutting Machines, Worm and Worm Wheel (Hob).

**HOBS**  
 Barber-Colman Co., Rockford, Ill.  
 Brown & Sharpe Mfg. Co., Providence.  
 Gould & Eberhardt, Newark, N. J.  
 Greenfield Tap & Die Corp., Greenfield, Mass.  
 Lees-Bradner Co., Cleveland, Ohio.  
 Meisselbach-Catucci Mfg. Co., Newark, N. J.  
 Michigan Tool Co., Detroit, Mich.  
 New Gear Cutting Mch. Co., Newark, N. J.  
 Union Twist Drill Co., Athol, Mass.

**HOISTING AND CONVEYING MACHINERY**  
 Link-Belt Co., Chicago, Ill.  
 Wright Mfg. Co., Bridgeport, Conn.

**HOISTS, AIR**  
 Hanna Engineering Works, 1763 Elston Ave., Chicago.  
 Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago.  
 Ingersoll-Rand Co., 11 Broadway, New York.

**HOISTS, CHAIN, ETC.**  
 Chisholm-Moore Hoist Corporation, 5038 Lakeside Ave., Cleveland, Ohio.  
 Ford Chain Block Co., Philadelphia.  
 Harrington Co., Philadelphia, Pa.  
 Niles-Bement-Pond Co., 111 Broadway, New York.  
 Reading Chain & Block Corp., Reading, Pa.  
 Roeper Crane and Hoist Works, Reading, Pa.  
 Ryerson & Sons, Joseph T., 2558 W. 16th St., Chicago, Ill.  
 Union Mfg. Co., New Britain, Conn.  
 Wright Mfg. Co., Bridgeport, Conn.  
 Yale & Towne Mfg. Co., Stamford, Conn.

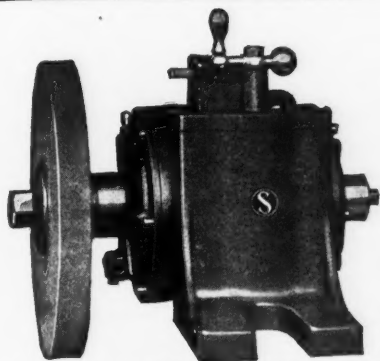
**HOISTS, ELECTRIC**  
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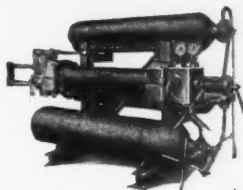


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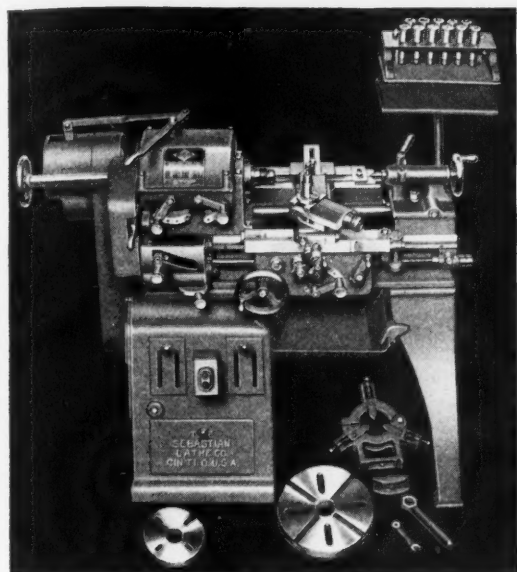
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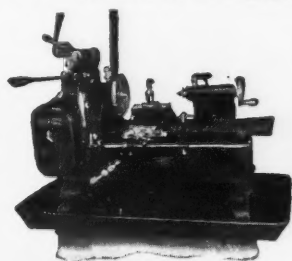
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Hi-Speed  
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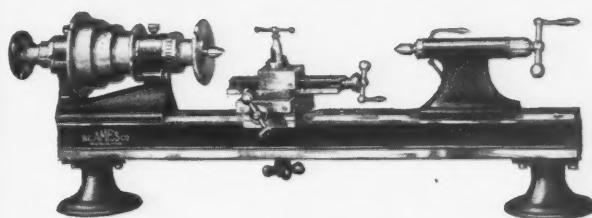
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Straight Ave., S. W., Grand Rapids,  
Mich.  
Hendey Mch. Co., Torrington, Conn.  
Ingersoll Milling Machine Co., Rock-  
ford, Ill.  
Kearney & Trecker Corp., Milwaukee,  
Wis.  
Kemp Smith Mfg. Co., Milwaukee, Wis.  
LeBlond, R. K. Machine Tool Co.,  
Cincinnati.  
McCroskey Tool Corp., Meadville, Pa.  
Niles-Bement-Pond Co., 111 Broadway,  
New York.  
Oesterlein Machine Co., Cincinnati.  
Ryerson & Son, Joseph T., 2558 W.  
16th St., Chicago, Ill.  
Sundstrand Machine Tool Co., Rock-  
ford, Ill.

#### MILLING MACHINES, HORIZONTAL, UNIVERSAL

Brown & Sharpe Mfg. Co., Providence.  
Cincinnati Milling Machine Co., Oak-  
ley, Cincinnati.  
Gallmeyer & Livingston Co., 344  
Straight Ave., S. W., Grand Rapids,  
Mich.  
Hendey Mch. Co., Torrington, Conn.  
Kearney & Trecker Corp., Milwaukee,  
Wis.  
Kemp Smith Mfg. Co., Milwaukee, Wis.  
LeBlond, R. K. Machine Tool Co.,  
Cincinnati.  
McCroskey Tool Corp., Meadville, Pa.  
Oesterlein Machine Co., Cincinnati.  
Preis, H. P. & Co., Inc., 227 Fulton  
St., New York.  
Rowbottom Mch. Co., Waterbury, Conn.  
Ryerson & Son, Joseph T., 2558 W.  
16th St., Chicago, Ill.  
Sundstrand Machine Tool Co., Rock-  
ford, Ill.  
Van Norman Mch. Tool Co., Spring-  
field, Mass.

#### MILLING MACHINES, LINCOLN TYPE

Brown & Sharpe Mfg. Co., Providence.  
Hendey Mch. Co., Torrington, Conn.  
Kemp Smith Mfg. Co., Milwaukee, Wis.  
Pratt & Whitney Co., Hartford, Conn.  
Van Norman Mch. Tool Co., Spring-  
field, Mass.

#### MILLING MACHINES, MULTIPLE SPINDLE

Automatic Mch. Co., Bridgeport, Conn.  
Consolidated Machine Tool Corp.,  
Rochester, N. Y.  
Ingersoll Milling Machine Co., Rock-  
ford, Ill.  
Niles-Bement-Pond Co., 111 Broadway,  
New York.

#### MILLING MACHINES, PORTABLE

Consolidated Machine Tool Corp.,  
Rochester, N. Y.  
Pedrick Tool & Mch. Co., 3639 N.  
Lawrence St., Philadelphia.  
Underwood Corp., H. B., Philadelphia.

#### MILLING MACHINES, SPLINE

Lees-Bradner Co., Cleveland, Ohio.  
Pratt & Whitney Co., Hartford, Conn.

#### MILLING MACHINES, VERTICAL

Brown & Sharpe Mfg. Co., Providence.  
Cincinnati Milling Mch. Co., Oakley,  
Cincinnati.  
Consolidated Mch. Tool Corp., Roches-  
ter, N. Y.  
Ingersoll Milling Machine Co., Rock-  
ford, Ill.  
Kearney & Trecker Corp., Milwaukee,  
Wis.  
Kemp Smith Mfg. Co., Milwaukee, Wis.  
Knight, W. B. Mch. Co., St. Louis,  
Mo.  
Niles-Bement-Pond Co., 111 Broadway,  
New York.  
Oesterlein Mch. Co., Cincinnati.  
Reed-Freestone Corp., Worcester, Mass.  
Van Norman Mch. Tool Co., Spring-  
field, Mass.

#### MILLING TOOLS, HOLLOW ADJUSTABLE

Geometric Tool Co., New Haven, Conn.  
Modern Tool Works, (Consolidated Mch.  
Tool Corp.) Rochester, N. Y.

#### MODEL AND EXPERIMENTAL WORK

See Special Machinery and Tools.

#### MOLDING MACHINES

Adams Co., Dubuque, Iowa.  
Hanna Engineering Works, 1763 Elston  
Ave., Chicago.  
Tabor Mfg. Co., Philadelphia, Pa.

#### MOTORS, ELECTRIC

Century Electric Co., St. Louis, Mo.  
Fairbanks-Morse & Co., 9 Wabash Ave.,  
Chicago.  
General Electric Co., Schenectady, N. Y.  
Lincoln Electric Co., Cleveland.  
Westinghouse Electric & Mfg. Co., East  
Pittsburgh, Pa.  
Wisconsin Electric Co., 25 16th St.,  
Racine, Wis.

#### NAME PLATES

Noble & Westbrook Mfg. Co., Hartford,  
Conn.  
Pittsburgh Stamp Co., Inc., 810 Canal  
St., Pittsburgh, Pa.  
Schwerdtle Stamp Co., Bridgeport, Ct.

#### NIBBLING MACHINES

National Machine Tool Co., 1536A  
Clark St., Racine, Wis.

#### NIPPLE THREADING MACHINERY

Bignall & Keeler Machine Works,  
Edwardsville, Ill.  
Landis Mch. Co., Inc., Waynesboro, Pa.  
Merrell Mfg. Co., 15 Curtis St., Toledo,  
Ohio.  
Murchey Mch. & Tool Co., 34 Porter  
St., Detroit.  
Saunders' Sons, Inc., D., Yonkers, N. Y.

#### NUTS, CASTELLATED

National Acme Co., Cleveland, O.

#### NUT TAPPERS

See Bolt and Nut Machinery.

#### ODOMETERS

Veeder-Root, Inc., Hartford, Conn.

#### OIL CUPS

Besly, Chas. H. & Co., 120-B N.  
Clinton St., Chicago.  
Boston Gear Works Sales Co., Norfolk  
Downs, Quincy, Mass.  
Bowen Products Corp., Auburn, N. Y.  
Cincinnati Ball Crank Co., Cincinnati.  
Gits Bros. Mfg. Co., 1911 S. Kilbourne  
Ave., Chicago, Ill.  
Tucker, W. W. & C. F., Hartford,  
Conn.

#### OILERS

Hanna Engineering Co., 1776 Elston  
Ave., Chicago.  
Madison-Kipp Corp., Madison, Wis.

#### OILERS, LOOSE PULLEY

Brown Engineering Co., 133 No. 3rd  
St., Reading, Pa.

#### OIL EXTRACTORS

Barrett, Leon J., Co., 1475 Grafton  
St., Worcester, Mass.  
Tolhurst Mch. Works, Troy, N. Y.

#### OIL GROOVING TOOLS

Cisco Machine Tool Co., Cincinnati.  
Hanson-Whitney Machine Co., Hart-  
ford, Conn.

#### OIL HOLE COVERS

Bowen Products Corp., Auburn, N. Y.  
Gits Bros. Mfg. Co., 1911 S. Kilbourne  
Ave., Chicago, Ill.  
Tucker, W. W. & C. F., Hartford,  
Conn.

#### OILS, LUBRICATING

Besly, Chas. H. & Co., 120-B N.  
Clinton St., Chicago.  
Lindsay-McMillan Co., Milwaukee, Wis.  
Standard Oil Co., (Indiana) 910 S.  
Michigan Ave., Chicago.

#### OILS, SOLUBLE

See Compound, Cutting, Grinding, etc.

#### OVENS, BAKING

American Gas Furnace Co., Elizabeth,  
N. J.  
General Electric Co., Schenectady, N. Y.

#### PACKING LEATHER

Chicago Rawhide Mfg. Co., 1279 Elston  
Ave., Chicago.  
Graton & Knight Mfg. Co., Worcester,  
Mass.

#### PARALLELS

Starrett Co., L. S., Athol, Mass.  
Walker Co., Inc., O. S., Worcester,  
Mass.

#### PATENTS

Parker, C. L., Washington, D. C.  
Snow, C. A. & Co., Washington, D. C.

#### PATTERN SHOP MACHINERY

Crescent Machine Co., 56 Main St.,  
Leontia, O.  
Porter-Cable Mch. Co., Syracuse, N. Y.

#### PATTERNS, METAL

Mummert-Dixon Co., Hanover, Pa.  
Sweet & Doyle Foundry & Mch. Co.,  
Troy, Green Island, N. Y.  
V & O Press Co., Hudson, N. Y.

#### PATTERNS, WOOD

Medart Co., St. Louis, Mo.  
Sweet & Doyle Foundry & Mch. Co.,  
Troy, Green Island, N. Y.  
V & O Press Co., Hudson, N. Y.

#### PENCILS, DRAWING

American Lead Pencil Co., 237 Fifth  
Ave., New York.

#### PHOSPHOR, BRONZE

See Bronze.

#### PINIONS, FORGED

See Gears, Forged.

#### PIPE BENDING TOOLS

Pedrick Tool & Mch. Co., 3639 N.  
Lawrence St., Philadelphia.  
Underwood Corp., H. B., Philadelphia.

#### PIPE CUTTING AND THREADING MACHINES

Arter Grinding Machine Co., Worcester,  
Mass.

Bignall & Keeler Machine Works,  
Edwardsville, Ill.

Curtis & Curtis Co., 324 Garden St.,  
Pittsburgh, Pa.

Foot-Burt Co., Cleveland.

Greenfield Tap & Die Corp., Greenfield,  
Mass.

Landis Mch. Co., Inc., Waynesboro, Pa.

Murchey Mch. & Tool Co., 34 Porter  
St., Detroit, Mich.

Niles-Bement-Pond Co., 111 Broadway,  
New York.

Ryerson & Son, Joseph T., 2558 W.  
16th St., Chicago, Ill.

Saunders' Sons, Inc., D., Yonkers, N. Y.

Williams Tool Corp., Erie, Pa.

#### PIPE STEEL

National Tube Co., Pittsburgh.

#### PLANNER ATTACHMENTS

Cincinnati Planer Co., Cincinnati.  
Gray, G. A., Co., Cincinnati.  
Hanson-Whitney Machine Co., Hart-  
ford, Conn.

#### PLANERS

American Tool Works Co., Cincinnati.

Cincinnati Planer Co., Cincinnati.

Cleveland Planer Co., Cleveland, O.

Consolidated Machine Tool Corp.,  
Rochester, N. Y.

Gray, G. A., Co., Cincinnati.

Liberty Mch. Tool Co., Hamilton, O.

Morton Mfg. Co., Muskegon Heights,  
Mich.

Niles-Bement-Pond Co., 111 Broadway,  
New York.

Reed-Prentice Corp., Worcester, Mass.

Rockford Mch. Tool Co., 2400 Kish-  
waukee Rd., Rockford, Ill.

Ryerson & Son, Joseph T., 2558 W.  
16th St., Chicago, Ill.

Sellers & Co., Inc., Wm., Philadelphia.

Shaw Crane-Putnam Machine Co., Inc.,  
Fitchburg, Mass.

#### PLANERS, CRANK

Cincinnati Shaper Co., Cincinnati.

Consolidated Machine Tool Corp.,  
Rochester, N. Y.

#### PLANERS, OPEN-SIDE

Automatic Mch. Co., Bridgeport, Conn.

Cincinnati Planer Co., Cincinnati.

Cleveland Planer Co., Cleveland, O.

Gray, G. A., Co., Cincinnati.

Liberty Mch. Tool Co., Hamilton, O.

Shaw Crane-Putnam Machine Co., Inc.,  
Fitchburg, Mass.

#### PLANERS, PORTABLE

Morton Mfg. Co., Muskegon Heights,  
Mich.

Underwood Corp., H. B., Philadelphia.

#### PLANERS, ROTARY

Cleveland Punch & Shear Works Co.,  
Cleveland.

Consolidated Machine Tool Corp.,  
Rochester, N. Y.

Niles-Bement-Pond Co., 111 Broadway,  
New York.

Pedrick Tool & Mch. Co., 3639 N.  
Lawrence St., Philadelphia.

Underwood Corp., H. B., Philadelphia.

#### PLANERS, TRAVELING HEAD

Morton Mfg. Co., Muskegon Heights,  
Mich.

Underwood Corp., H. B., Philadelphia.

#### PLATE ROLLS

Cleveland Punch & Shear Works Co.,  
Cleveland.

Niles-Bement-Pond Co., 111 Broadway,  
New York.

Ryerson & Son, Joseph T., 2558 W.  
16th St., Chicago.

Wickes Bros., Saginaw, Mich.

#### PLATES, STEEL

Carnegie Steel Co., Pittsburgh, Pa.

#### PLATES, SURFACE

Brown & Sharpe Mfg. Co., Providence.

#### PNEUMATIC DIE CUSHIONS FOR POWER PRESSES

Marquette Tool & Mfg. Co., 321 W.  
Ohio St., Chicago.

#### PNEUMATIC EQUIPMENT

Hannifin Mfg. Co., 621-631 S. Kolmar  
Ave., Chicago, Ill.

Independent Pneumatic Tool Co., 600  
W. Jackson Blvd., Chicago.

Logansport Machine Co., 529 Market  
St., Logansport, Ind.

Manning, Maxwell & Moore, Inc., 100  
East 42nd St., New York.

#### POLISHING LATHES AND MACHINES

Abbott Ball Co., 1045 New Britain  
Ave., Hartford, Conn.

Automatic Buffing Mch. Co., Buffalo,  
N. Y.

Badger Tool Co., Beloit, Wis.

Besly, Chas. H. & Co., 120-B N.  
Clinton St., Chicago.

Biax Flexible Shaft Co., Inc., 20 East  
17th St., New York.

Black & Decker Mfg. Co., Baltimore,  
Md.

Bridgeport Safety Emery Wheel Co.,  
Inc., 1283 W. Broad St., Bridge-  
port, Conn.

Cincinnati Electrical Tool Co., Cin-  
cinnati.

Cisco Machine Tool Co., Cincinnati, O.

Cleveland Stone Co., Cleveland.

Diamond Machine Co., Providence, R. I.

Gardner Machine Co., 414 E. Gardner  
St., Beloit, Wis.

Hill-Curtis Co., 1406 N. Pitcher St.,  
Kalamazoo, Mich.

New Britain Mch. Co., New Britain,  
Conn.

Production Mch. Co., Greenfield, Mass.

Royersford Fdry. & Machine Co., Box  
M, Royersford, Pa.

Standard Electrical Tool Co., 1936 W.  
8th St., Cincinnati.

Stow Mfg. Co., Binghamton, N. Y.

U. S. Electrical Tool Co., Cincinnati.

#### PRESSES, ARBOR

American Broach & Machine Co., Ann  
Arbor, Mich.

Atlas Press Co., Kalamazoo, Mich.

Barnes, W. F. & John, 231 Ruby  
St., Rockford, Ill.

Canedy-Otto Mfg. Co., Chicago Heights,  
Ill.

French Oil Mill Mch. Co., Piqua, O.

Hannifin Mfg. Co., 621-631 S. Kolmar  
Ave., Chicago, Ill.

Logansport Machine Co., 529 Market  
St., Logansport, Ind.

Lucas Machine Tool Co., Cleveland.

Nicholson & Co., W. H., 112 Oregon  
St., Wilkes-Barre, Pa.

#### PRESSES, BROACHING

Adriance Mch. Works, Inc., 78 Rich-  
ards St., Brooklyn, N. Y.

American Broach & Machine Co., Ann  
Arbor, Mich.

Atlas Press Co., Kalamazoo, Mich.

Bliss Co., E. W., Brooklyn, N. Y.

Ferracute Machine Co., Bridgeton, N. J.

Lucas Machine Tool Co., Cleveland, O.

Metalwood Mfg. Co., Detroit, Mich.

Oilgear Co., 660 Park St., Milwaukee,  
Wis.

Peck, Stow & Wilcox Co., Southington,  
Conn.

Toledo Machine & Tool Co., Toledo, O.

V & O Press Co., Hudson, N. Y.

Watson-Stillman Co., 73 West St., New  
York City.

#### PRESSES, DROP

See Hammers, Drop.

#### PRESSES, FOOT

Adriance Mch. Works, Inc., 78 Rich-  
ards St., Brooklyn, N. Y.

Baird Mch. Co., Bridgeport, Conn.

Bliss Co., E. W., Brooklyn, N. Y.

Etna Machine Co., Toledo, O.

Ferracute Machine Co., Bridgeton, N. J.

Niagara Mch. & Tool Works, Buffalo,  
N. Y.

Peck, Stow & Wilcox Co., Southington,  
Conn.

Shuster Co., F. B., New Haven, Conn.

Toledo Machine & Tool Co., Toledo, O.

V & O Press Co., Hudson, N. Y.

Waterbury Farrel Fdry. & Mch. Co.,  
Waterbury, Conn.

#### PRESSES, FORGING

Adriance Mch. Works, Inc., 78 Rich-  
ards St., Brooklyn, N. Y.



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American Can Co., 120 Broadway, New York.  
Automatic Mch. Co., Bridgeport, Conn.  
Baird Mch. Co., Bridgeport, Conn.  
Bliss Co., E. W., Brooklyn, N. Y.  
Cleveland Punch & Shear Works Co., Cleveland.  
Federal Press Co., Elkhart, Ind.  
Ferracute Machine Co., Bridgeton, N. J.  
LaSalle Mch. Works, Inc., 3009 S. LaSalle St., Chicago.  
Loshbough-Jordan Tool & Mch. Co., Elkhart, Ind.  
Minster Machine Co., Minster, Ohio.  
Niagara Mch. & Tool Works, Buffalo.  
Peck, Stow & Wilcox Co., Southington, Conn.  
Taylor-Shantz Co., Rochester, N. Y.  
Toledo Machine & Tool Co., Toledo, O.  
V & O Press Co., Hudson, N. Y.  
Waterbury Farrel Fdry. & Mch. Co., Waterbury, Conn.

#### PRESSES, STRAIGHTENING

Candey-Otto Mfg. Co., Chicago Heights, Ill.  
Elmes, Chas. F., Engineer Wks., 222 N. Morgan St., Chicago.  
French Oil Mill Mch. Co., Piqua, O.  
Metalwood Mfg. Co., Detroit, Mich.  
Morse Twist Drill & Mch. Co., New Bedford, Mass.  
Springfield Machine Tool Co., 691 Southern Ave., Springfield, O.  
Watson-Stillman Co., 73 West St., New York.

#### PROFILING MACHINES

Automatic Mch. Co., Bridgeport, Conn.  
Consolidated Machine Tool Corp., Rochester, N. Y.  
Frew Machine Co., Philadelphia.  
Gorton, Geo., Mch. Co., Racine, Wis.  
Leland-Gifford Co., Worcester, Mass.  
Pratt & Whitney Co., Hartford, Conn.  
Reed-Prentice Corp., Worcester, Mass.

#### PULLEYS

American Pulley Co., Philadelphia.  
Boston Gear Works Sales Co., Norfolk Downs, Quincy, Mass.  
Brown Co., A. & F., 79 Barclay St., New York.  
Foote Bros. Gear & Mch. Co., 232-242 W. Curtis St., Chicago.  
Johnson Machine Co., Carlyle, Manchester, Conn.  
Jones Foundry & Mch. Co., W. A., 4409 W. Roosevelt Rd., Chicago.  
Link-Belt Co., Chicago, Ill.  
Medart Co., St. Louis, Mo.  
Moore & White Co., 2707-2737 No. 15th St., Philadelphia.  
Sellers & Co., Inc., Wm., Philadelphia.  
Smith, Winfield H., 116 Eaton St., Springfield, N. Y.  
Wood's, T. B., & Sons Co., Chambersburg, Pa.

#### PULLEYS, FRICTION

American Pulley Co., Philadelphia.  
Brown Co., A. & F., 79 Barclay St., New York.  
Conway Clutch Co., Cincinnati.  
Johnson Machine Co., Carlyle, Manchester, Conn.  
Jones Foundry & Mch. Co., W. A., 4409 W. Roosevelt Rd., Chicago.  
Link-Belt Company, Chicago.  
Medart Co., St. Louis, Mo.  
Moore & White Co., 2707-2737 No. 15th St., Philadelphia.  
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#### PULLEY TREADS

American Manganese Steel Co., 1850 McCormick Bldg., Chicago.  
Smith & Serrell, Newark, N. J.

#### PULLEYS TURNING AND BORING MACHINES

American Tool Works Co., Cincinnati.  
LeBlond, R. K., Machine Tool Co., Cincinnati.  
Niles-Bement-Pond Co., 111 Broadway, New York.

#### PUMP LEATHERS

Chicago Rawhide Mfg. Co., 1279 Elston Ave., Chicago.  
Graton & Knight Mfg. Co., Worcester, Mass.

#### PUMPS, HYDRAULIC

Buffalo Forge Co., Buffalo, N. Y.  
Elmes, Chas. F., Engineer Wks., 222 N. Morgan St., Chicago.  
French Oil Mill Mch. Co., Piqua, O.  
Ingersoll-Rand Co., (A. S. Cameron Pump Wks.) 11 B'way, New York.  
Metalwood Mfg. Co., Detroit, Mich.  
Oilgear Co., 660 Park St., Milwaukee, Wis.  
Watson-Stillman Co., 73 West St., New York.

#### PUMPS, LUBRICANT AND OIL

Brown & Sharpe Mfg. Co., Providence, R. I.  
Ross Mfg. Co., Cleveland, Ohio.  
Ruthman Mch. Co., Cincinnati, Ohio.

#### PUMPS, PNEUMATIC

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National Acme Co., Cleveland, Ohio.

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Starrett Co., L. S., Athol, Mass.

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Buffalo Forge Co., Buffalo, N. Y.  
Cleveland Punch & Shear Works Co., Cleveland.  
Consolidated Machine Tool Corp., Rochester, N. Y.  
Ferracute Machine Co., Bridgeton, N. J.  
Loshbough-Jordan Tool & Mch. Co., Elkhart, Ind.  
Mitts & Merrill, 843 Water St., Saginaw, Mich.  
Niagara Mch. & Tool Works, Buffalo.  
Peck, Stow & Wilcox Co., Southington, Conn.  
Roversford Fdry. & Machine Co., Box M., Roversford, Pa.  
Ryerson & Son, Joseph T., 2558 W. 16th St., Chicago, Ill.  
Union Mfg. Co., New Britain, Conn.  
Watson-Stillman Co., 73 West St., New York.  
Wickes Bros., Saginaw, Mich.

#### PYROMETERS

American Gas Furnace Co., Elizabeth, N. J.  
Bristol Co., Waterbury, Conn.  
Hoskins Mfg. Co., Detroit, Mich.  
Leeds & Northrup Co., Philadelphia.  
Shore Instrument & Mfg. Co., Jamaica, N. Y.  
Wilson-Maeulen Co., Inc., 382 Concord Ave., New York.

#### RACK CUTTING MACHINES AND ATTACHMENTS

Adams Co., Dubuque, Iowa.  
Gould & Eberhardt, Newark, N. J.  
LeBlond Machine Tool Co., R. K., Cincinnati.  
Scherr, Geo., Co., 144 Liberty St., N. Y.

#### RACKS, CUT

Adams Co., Dubuque, Ia.  
Fellows Gear Shaper Co., Springfield, Vt.  
Foote Bros. Gear & Mch. Co., 232-242 N. Curtis St., Chicago.  
Hartford Special Mch. Co., Hartford, Conn.  
Horsburgh & Scott Co., Cleveland.  
Massachusetts Gear & Tool Co., Woburn, Mass.  
Meisel Press Mfg. Co., 948 Dorchester Ave., Boston 25, Mass.  
Newark Gear Cutting Machine Co., Newark, N. J.  
Nuttall, R. D., Co., Pittsburgh, Pa.  
Philadelphia Gear Works, Philadelphia.  
Scherr, Geo., Co., 144 Liberty St., New York.  
Simonds Mfg. Co., Pittsburgh, Pa.  
Stahl Gear & Mch. Co., Cleveland.

#### RACKS, STOCK, TOOL AND PATTERN

Brown Engineering Co., 133 N. 3rd St., Reading, Pa.  
New Britain Mch. Co., New Britain, Ct.  
Pollard Bros. Mfg. Co., 4035 N. Tripp Ave., Chicago.

#### RADIATORS, JAPANNING-OVEN

American Gas Furnace Co., Elizabeth, N. J.

#### REAMER HOLDERS, FLOATING

Landis Mch. Co., Inc., Waynesboro, Pa.  
McCrosky Tool Corp., Meadville, Pa.  
Nicholson & Co., W. H., 112 Oregon St., Wilkes-Barre, Pa.  
Scully-Jones & Co., 13th and Robey Sts., Chicago.

#### REAMERS

Barber-Colman Co., Rockford, Ill.  
Brown & Sharpe Mfg. Co., Providence.  
Brubaker & Bros. Co., W. L., 50 Church St., New York.  
Card Mfg. Co., S. W. Div. of Union Twist Drill Co., Mansfield, Mass.  
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.  
Cleveland Twist Drill Co., Cleveland.  
Columbus Die Tool & Mch. Co., Columbus, O.  
Davis Boring Tool Co., Inc., 6200 Maple Ave., St. Louis, Mo.  
Gammons-Holman Co., Manchester, Ct.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
McCrosky Tool Corp., Meadville, Pa.  
Michigan Tool Co., Detroit, Mich.  
Morse Twist Drill & Mch. Co., New Bedford, Mass.  
National Twist Drill & Tool Co., Detroit.  
Pratt & Whitney Co., Hartford, Conn.  
Reiff & Nestor, Lykens, Pa.  
Standard Tool Co., Cleveland.  
Union Twist Drill Co., Athol, Mass.

#### REAMERS, ADJUSTABLE

Barber-Colman Co., Rockford, Ill.  
Cleveland Twist Drill Co., Cleveland.  
Davis Boring Tool Co., Inc., 6200 Maple Ave., St. Louis, Mo.  
Gisholt Machine Co., 1300 E. Washington Ave., Madison, Wis.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill.  
McCrosky Tool Corp., Meadville, Pa.  
Morse Twist Drill & Mch. Co., New Bedford, Mass.

Pratt & Whitney Co., Hartford, Conn.  
Reiff & Nestor, Lykens, Pa.  
Union Twist Drill Co., Athol, Mass.  
Wetmore Reamer Co., 60 27th St., Milwaukee, Wis.

#### REAMERS, PORTABLE ELECTRIC

U. S. Electrical Tool Co., Cincinnati.

#### REAMERS, TAPER PIN HOLE

Gammons-Holman Co., Manchester, Ct.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Pratt & Whitney Co., Hartford, Conn.  
Reiff & Nestor, Lykens, Pa.  
Union Twist Drill Co., Athol, Mass.

#### REAMING MACHINES

Blanchard Machine Co., 64 State St., Cambridge, Mass.

#### RECORDING INSTRUMENTS FOR ELECTRICITY

Bristol Co., Waterbury, Conn.  
General Electric Co., Schenectady, N. Y.  
Leeds & Northrup Co., Philadelphia.

#### RECORDING INSTRUMENTS FOR PRESSURE

Bristol Co., Waterbury, Conn.  
Leeds & Northrup Co., Philadelphia.

#### RECORDING INSTRUMENTS FOR SPEED

Bristol Co., Waterbury, Conn.  
Leeds & Northrup Co., Philadelphia.

#### RECORDING INSTRUMENTS FOR TEMPERATURE

American Gas Furnace Co., Elizabeth, N. J.  
Bristol Co., Waterbury, Conn.  
Ferner, R. Y., Co., Washington, D. C.  
Gisholt Machine Co., 1300 E. Washington Ave., Madison, Wis.  
Wilson-Maeulen Co., Inc., 382 Concord Ave., New York.

#### RECORDING INSTRUMENTS FOR TIME

Bristol Co., Waterbury, Conn.  
Ferner, R. Y., Co., Washington, D. C.  
Gisholt Machine Co., 1300 E. Washington Ave., Madison, Wis.

#### REELS FOR HOLDING STOCK

S. & S. Mch. Wks., 4541 W. Lake St., Chicago, Ill.

#### REGULATORS, TEMPERATURE

General Electric Co., Schenectady, N. Y.  
Leeds & Northrup Co., Philadelphia.  
Wilson-Maeulen Co., Inc., 382 Concord Ave., New York.

#### REMOVERS, JAPAN, ENAMEL ETC.

Okite Products, Inc., 26 Thames St., New York.

#### RHEOSTATS

General Electric Co., Schenectady, N. Y.  
Monitor Controller Co., Baltimore, Md.  
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

#### RINGS, WELDLESS

Dyson & Son, Joseph, Cleveland.  
Johnston & Jennings Co., Addison Rd. and Lake Shore R. R. Tracks, Cleveland, O.

#### RIVETERS, ELECTRIC

Taylor-Winfield Corp., Warren, Ohio.

#### RIVETERS, HYDRAULIC

Hanna Engineering Works, 1763 Elston Ave., Chicago.  
Oilgear Co., 660 Park St., Milwaukee, Wis.

#### RIVETERS, PNEUMATIC

Grant Mfg. & Mch. Co., N.W. Station, Bridgeport, Conn.  
Hanna Engineering Works, 1763 Elston Ave., Chicago.  
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago.  
Ingersoll-Rand Co., 11 Broadway, New York.

#### RIVETERS, STEAM

Hanna Engineering Works, 1763 Elston Ave., Chicago.

#### RIVETING MACHINES

Buffalo Forge Co., Buffalo, N. Y.  
Grant Mfg. & Mch. Co., N.W. Station, Bridgeport, Conn.  
Hanna Engineering Works, 1763 Elston Ave., Chicago.  
High Speed Hammer Co., Inc., Rochester, N. Y.  
Niles-Bement-Pond Co., 111 Broadway, New York.  
Peck, Stow & Wilcox Co., Southington, Conn.  
Ryerson & Son, Joseph T., 2558 W. 16th St., Chicago, Ill.  
Shuster Co., F. B., New Haven, Conn.  
Townsend, H. P., Mfg. Co., Hartford, Conn.

#### RIVET SETS

Cleveland Punch & Shear Works Co., Cleveland.  
Hunter Saw & Mch. Co., 5662 Butler St., Pittsburgh, Pa.  
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago.  
Ingersoll-Rand Co., 11 Broadway, New York.  
Williams, J. H., & Co., Buffalo, N. Y.

#### ROD CUTTERS, HAND POWER

Tucker, W. W. & C. F., Hartford, Conn.

#### ROD CUTTING MACHINES

Union Mfg. Co., New Britain, Conn.

#### ROLLING MACHINES, TAPERED FORGING

Ajax Mfg. Co., Cleveland.

#### ROLLING MILL MACHINERY

Ajax Mfg. Co., Cleveland, Ohio.  
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

#### ROPE DRIVES

Link-Belt Company, Chicago.  
Wood's, T. B., & Sons Co., Chambersburg, Pa.

#### RULES, STEEL

Brown & Sharpe Mfg. Co., Providence.  
Keuffel & Esser Co., Hoboken, N. J.  
Starrett Co., L. S., Athol, Mass.

#### RUST PREVENTIVE

Okite Products, Inc., 26 Thames St., New York.

#### SAFETY GUARDS FOR PUNCH PRESSES

Taylor-Shantz Co., Rochester, N. Y.  
Wiesman Mfg. Co., Dayton, O.

#### SAND BLAST EQUIPMENT

Ingersoll-Rand Co., 11 Broadway, New York.  
Leiman Bros., 23 Walker St., New York.

#### SANDERS

Porter-Cable Mch. Co., Syracuse, N. Y.

#### SAW BLADES, CIRCULAR METAL CUTTING

Crescent Machine Co., 56 Main St., Leetonia, O.  
Hunter Saw & Mch. Co., 5662 Butler St., Pittsburgh, Pa.  
Huther Bros. Saw Mfg. Co., Inc., Rochester, N. Y.  
Simonds Saw & Steel Co., Fitchburg, Mass.  
Tabor Mfg. Co., Philadelphia.

#### SAW BLADES, HACK

American Saw & Mfg. Co., Springfield, Mass.  
Diamond Saw & Stamping Wks., Buffalo, N. Y.  
Millers Falls Co., Millers Falls, Mass.  
Simonds Saw & Steel Co., Fitchburg, Mass.  
Starrett Co., L. S., Athol, Mass.  
Thompson, Henry G., & Son Co., New Haven, Conn.

#### SAW BLADES, METAL CUTTING BAND

American Saw & Mfg. Co., Springfield, Mass.  
Huther Bros. Saw & Mfg. Co., Inc., Rochester, N. Y.  
Simonds Saw & Steel Co., Fitchburg, Mass.  
Thompson, Henry G., & Son Co., New Haven, Conn.

#### SAW FILING, SETTING AND GRINDING MACHINES, CIRCULAR

Wardwell Mfg. Co., Cleveland.

#### SAW FILING AND SETTING MACHINES, BAND

Wardwell Mfg. Co., Cleveland.

#### SAW FRAMES, HACK

Diamond Saw & Stamping Works, Buffalo, N. Y.  
Millers Falls Co., Millers Falls, Mass.  
Simonds Saw & Steel Co., Fitchburg, Mass.  
Starrett Co., L. S., Athol, Mass.

#### SAW SHARPENING MACHINES

Earle Gear & Machine Co., 4707 Stenton Ave., Philadelphia, Pa.  
Hanna Engineering Works, 1763 Elston Ave., Chicago.  
Hunter Saw & Mch. Co., 5662 Butler St., Pittsburgh, Pa.  
Huther Bros. Saw Mfg. Co., Inc., Rochester, N. Y.  
Wardwell Mfg. Co., Cleveland, O.

#### SAW TABLES

Baker Bros., Inc., Toledo, O.  
Crescent Machine Co., 56 Main St., Leetonia, O.  
Frew Machine Co., Philadelphia.

#### SAWING MACHINES, CIRCULAR

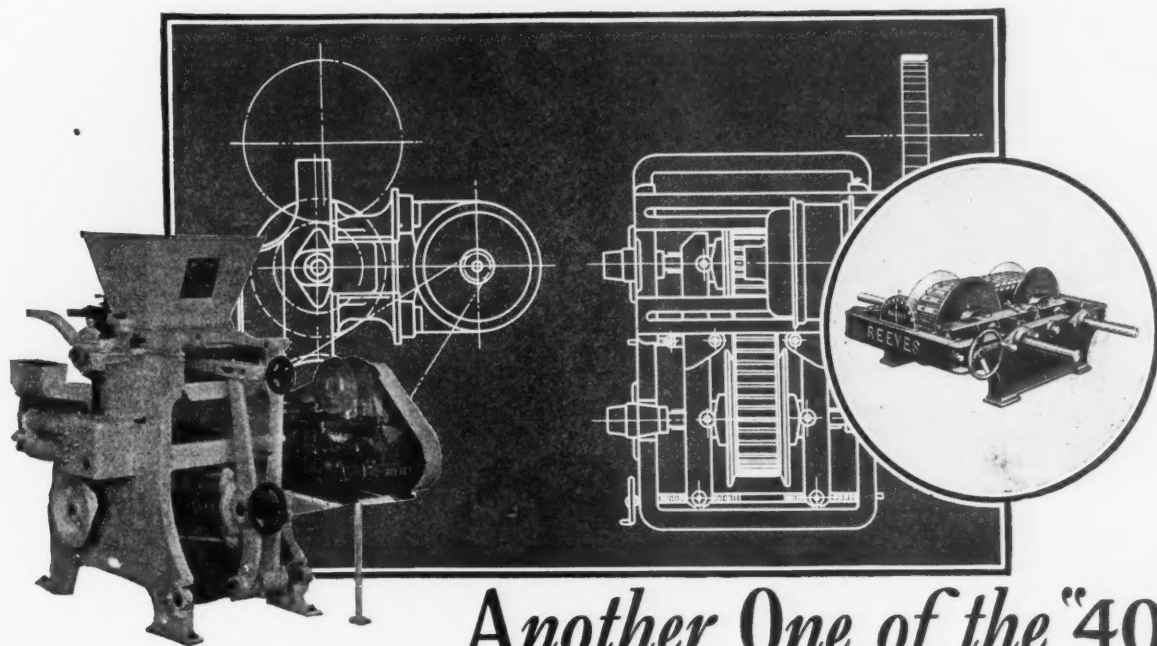
Armstrong-Blum Mfg. Co., 343 N. Francisco Ave., Chicago.  
Consolidated Machine Tool Corp., Rochester, N. Y.  
Earle Gear & Machine Co., 4707 Stenton Ave., Philadelphia.  
Espin-Lucas Mch. Works, Philadelphia.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Hanna Engineering Works, 1763 Elston Ave., Chicago.

#### SAWING MACHINES, FRICTION

Hunter Saw & Mch. Co., 5662 Butler St., Pittsburgh, Pa.  
Ryerson & Son, Joseph T., 2558 W. 16th St., Chicago.



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## Another One of the "400" Who Incorporate the REEVES Transmission!

THE "American Divider" is adjustable in speed to measure *accurately* the weight and volume of dough regardless of differences in type or consistency of the dough under any operating condition.

The American Bakers Machinery Co. of St. Louis has used REEVES Transmissions for many years. A 1 H. P. motor is mounted on a standard base above the No. 00-F REEVES Transmission and is connected to the constant speed shaft of the Transmission with silent chain.

The variable speed shaft is connected to the driving shaft of the divider with

pinion and gear. This complete driving equipment is mounted on a pedestal, and the Transmission is equipped with speed indicator which enables the operator at all times to know the exact speed at which the machine is running.

Think how flexible the REEVES makes the American Divider—think of the sales advantages it has over single-speed or step-adjustable dividers!

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almost any type of production machine. REEVES engineers constantly are working out compact, efficient methods of application for progressive machinery manufacturers in almost every field of industry. More than 400 already incorporate or furnish the REEVES as a part of the machines they build.

Will speed adjustability increase the efficiency of your machines and give them added sales value? Talk it over with REEVES engineers. Put your name and address in the lower margin, tear off and mail today for the new REEVES catalog which gives more detailed information about the REEVES advantages.

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Ajax Mfg. Co., Cleveland, O.  
Armstrong-Blum Mfg. Co., 343 N. Francisco Ave., Chicago.  
Avery Drilling Machine Co., Cincinnati.  
Jarvis, Inc., Benl. E., Newark, N. J.  
Racine Tool & Machine Co., 250 15th St., Racine, Wis.

**SAWING MACHINES, POWER HACK**

Armstrong-Blum Mfg. Co., 343 N. Francisco Ave., Chicago.  
Diamond Saw & Stamping Works, Buffalo, N. Y.  
Hanna Engineering Works, 1763 Elston Ave., Chicago.  
Millers Falls Co., Millers Falls, Mass.  
Peerless Machine Co., Racine, Wis.  
Racine Tool & Machine Co., 250 15th St., Racine, Wis.

**SAWING MACHINES, WOOD**

Barnes Co., W. F. & John, 231 Ruby St., Rockford, Ill.  
Crescent Machine Co., 56 Main St., Leontia, O.

**SAWS, PORTABLE PNEUMATIC**

Ingersoll-Rand Co., 11 Broadway, New York.

**SAWS, SCREW SLOTTING**

Barber-Colman Co., Rockford, Ill.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Starrett Co., L. S., Athol, Mass.  
Union Twist Drill Co., Athol, Mass.

**SCRAPING TOOLS, METAL, POWER DRIVEN**

Anderson Bros. Mfg. Co., Rockford, Ill.

**SCREENS, PERFORATED**

Chicago Perforating Co., 2442 West 24th Place, Chicago.

**SCREW CUTTING TOOLS**

See Taps and Dies.

**SCREW DRIVING MACHINES**

Biax Flexible Shaft Co., Inc., 20 East 17th St., New York.  
Errington Mechanical Laboratory, Broadway and John St., New York.  
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago.  
Strand & Co., N. A., 5001 N. Lincoln St., Chicago.

**SCREW MACHINES, AUTOMATIC**

Brown & Sharpe Mfg. Co., Providence, R. I.  
Cleveland Automatic Mch. Co., Cleveland, Ohio.  
Cone Automatic Mch. Co., Inc., Windsor, Vt.  
National Acme Co., Cleveland.  
New Britain Mch. Co., New Britain, Ct.  
Townsend, H. F., Mfg. Co., Hartford, Conn.

**SCREW MACHINES, HAND**

See also Lathes, Turret.  
Acme Machine Tool Co., Cincinnati.  
Bardons & Oliver, Cleveland.  
Brown & Sharpe Mfg. Co., Providence.  
Drees Machine Tool Co., Cincinnati.  
Foster Machine Co., Elkhart, Ind.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Jones & Lamson Machine Co., Springfield, Vt.  
Potter & Johnston Machine Co., Pawtucket, R. I.  
Pratt & Whitney Co., Hartford, Conn.  
Rivett Lathe & Grinder Corp., Brighton, Boston.  
Stark Tool Co., Waltham, Mass.  
Warner & Swasey Co., Cleveland.

**SCREW MACHINES, MULTIPLE SPINDLE**

Cleveland Automatic Mch. Co., Cleveland, Ohio.  
Cone Automatic Mch. Co., Inc., Windsor, Vt.  
National Acme Co., Cleveland.  
New Britain Mch. Co., New Britain, Ct.

**SCREW MACHINE TOOLS AND EQUIPMENT**

Bardons & Oliver, Cleveland.  
Brown & Sharpe Mfg. Co., Providence.  
Cleveland Automatic Mch. Co., Cleveland, R. I.  
Foster Machine Co., Elkhart, Ind.  
Jones & Lamson Machine Co., Springfield, Vt.  
National Acme Co., Cleveland.  
New Britain Mch. Co., New Britain, Ct.  
Potter & Johnston Machine Co., Pawtucket, R. I.  
Pratt & Whitney Co., Hartford, Conn.  
Steinle Turret Machine Co., Madison, Wis.  
Warner & Swasey Co., Cleveland.

**SCREW MACHINE WORK**

Brown Engineering Co., 133 N. Third St., Reading, Pa.  
Buckeye Brass & Mfg. Co., Cleveland.  
Eastern Machine Screw Corp., New Haven, Conn.  
H. & G. Works, Eastern Mch. Screw Corp., New Haven, Conn.  
Link-Belt Co., Chicago, Ill.  
Meissel Press Mfg. Co., 948 Dorchester Ave., Boston 25, Mass.  
National Acme Co., Cleveland.  
New Britain Mch. Co., New Britain, Ct.  
Poorman, J. E., Philadelphia.  
Reliance Die & Stamping Co., 515 N. LaSalle St., Chicago.  
Standard Pressed Steel Co., Jenkin-town, Pa.  
Wicaco Screw & Mch. Works, Inc., Philadelphia.

**SCREW PLATES**

Besly, Chas. H. & Co., 120-B N. Clinton St., Chicago.  
Brubaker & Bros. Co., W. L., 50 Church St., New York.  
Card Mfg. Co., S. W. Div. of Union Twist Drill Co., Mansfield, Mass.  
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.  
Greenfield Tap & Die Corp., Greenfield, Mass.  
Hjorth Lathe & Tool Co., Boston.  
Morse Twist Drill & Mch. Co., New Bedford, Mass.  
Pratt & Whitney Co., Hartford, Conn.

**SCREWS, CAP, SET AND MACHINERY**

Allen Mfg. Co., 125 Shelton St., Hartford, Conn.  
National Acme Co., Cleveland.  
Poorman, J. E., Philadelphia.  
Strong, Carlisle & Hammond Co., Cleveland.

**SCREWS, SAFETY SET**

Allen Mfg. Co., 125 Shelton St., Hartford, Conn.  
Bristol Co., Waterbury, Conn.  
Standard Pressed Steel Co., Jenkin-town, Pa.  
Strong, Carlisle & Hammond Co., Cleveland.

**SCREWS, SELF-TAPPING DRIVE**

Parker-Kalon Corp., 200 Varick St., New York.

**SCREWS, SPECIAL LEAD, FEED, ETC.**

Automatic Mch. Co., Bridgeport, Conn.  
Ferner, R. Y., Co., Washington, D. C.  
Hindley Gear Co., Philadelphia.

**SEAMLESS STEEL TUBING**

See Tubing, Seamless Steel.

**SECOND-HAND MACHINERY, ETC.**

Allen, H. F., Co., Inc., 30 Church St., New York.  
Botwinick Bros., New Haven, Conn.  
Cincinnati Planer Co., Cincinnati.  
Eastern Machinery Co., Cincinnati.  
Esley Mch. Co., E. L., 551-57 W. Washington Blvd., Chicago.  
General Machinery Co., 170 Summer St., Boston, Mass.  
Hymen & Sons, Joseph, Philadelphia.  
Lucas, Frank B., Bridgeport, Conn.  
Miles Mch. Co., Saginaw, Mich.  
Morey & Co., Inc., 404 Broome St., New York.  
Niles-Bement-Pond Co., 111 Broadway, New York.  
Osborne & Sexton Mch. Co., Columbus, Ohio.  
Randle Mch. Co., Cincinnati, Ohio.  
Ryerson & Son, Joseph T., 2558 W. 16th St., Chicago.  
Scott-Bansbach Mch. Co., 130 So. Clinton St., Chicago, Ill.  
Wayne Mch. Co., Fort Wayne, Ind.

**SEPARATORS, CENTRIFUGAL**

Barrett, Leon J., Co., 1475 Grafton St., Worcester, Mass.  
National Acme Co., Cleveland, Ohio.  
Tolhurst Mch. Works, Troy, N. Y.  
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

**SHAFTING, STEEL**

Adamson Mch. Co., Akron, O.  
Brown Co., A. & F., 79 Barclay St., New York.  
Medart Co., St. Louis, Mo.  
Roversford Foundry & Machine Co., Box M, Roversford, Pa.  
Standard Pressed Steel Co., Jenkin-town, Pa.  
Union Drawn Steel Co., Beaver Falls, Pa.

**SHAFTING, STEEL TUBING FOR**

National Tube Co., Pittsburgh.

**SHAFTS, FLEXIBLE**

Biax Flexible Shaft Co., Inc., 20 East 17th St., New York.  
Chicago Flexible Shaft Co., 1154 S. Central Ave., Chicago, Ill.  
Errington Mechanical Laboratory, Broadway and John St., New York.  
Haskins, R. G., Co., 4634 Fulton St., Chicago.  
Oliver Instrument Co., 1410 East Maumee St., Adrian, Mich.  
Stow Mfg. Co., Binghamton, N. Y.  
Strand & Co., N. A., 5001 N. Lincoln St., Chicago.

**SHAFTS, HOLLOW BORED**

American Hollow Boring Co., Erie, Pa.

**SHAPERS**

American Tool Works Co., Cincinnati.  
Cincinnati Shaper Co., Cincinnati.  
Columbia Machine Tool Co., Hamilton, Ohio.  
Gould & Eberhardt, Newark, N. J.  
Hendey Mch. Co., Torrington, Conn.  
Kelly Co., R. A., Xenia, O.  
Morton Mfg. Co., Muskegon Heights, Mich.  
Niles-Bement-Pond Co., 111 Broadway, New York.  
Osborne & Sexton Mch. Co., Columbus, Ohio.  
Potter & Johnston Machine Co., Pawtucket, R. I.  
Rhodes Mfg. Co., Hartford, Conn.  
Rockford Mch. Tool Co., 2400 Kishwaukee Rd., Rockford, Ill.  
Smith & Mills Co., Cincinnati.  
Springfield Mch. Tool Co., 651 Southern Ave., Springfield, O.  
Western Machine Tool Works, Holland, Mich.

**SHAPERS, DRAW-OUT**

Morton Mfg. Co., Muskegon Heights, Mich.

**SHAPERS, PORTABLE**

Reed-Prentice Corp., Worcester, Mass.

**SHAPERS, TRAVELING HEAD**

Cincinnati Shaper Co., Cincinnati.  
Morton Mfg. Co., Muskegon Heights, Mich.  
Niles-Bement-Pond Co., 111 Broadway, New York.

**SHAPERS, VERTICAL**

Hanson-Whitney Machine Co., Hartford, Conn.  
Pratt & Whitney Co., Hartford, Conn.  
Rhodes Mfg. Co., Hartford, Conn.

**SHAPES, STRUCTURAL STEEL**

Carnegie Steel Co., Pittsburgh, Pa.

**SHEARING MACHINERY**

Buffalo Forge Co., Buffalo, N. Y.  
Canton Fdry. & Mch. Co., Canton, O.  
Cleveland Punch & Shear Works Co., Cleveland.  
Consolidated Machine Tool Corp., Rochester, N. Y.  
Ferracute Machine Co., Bridgeton, N. J.  
Niagara Mch. & Tool Works, Buffalo.  
Peck, Stow & Wilcox Co., Southington, Conn.  
Roversford Foundry & Mch. Co., Box M, Roversford, Pa.  
Ryerson & Son, Joseph T., 2558 W. 16th St., Chicago.  
Union Mfg. Co., New Britain, Conn.  
Watson-Stillman Co., 73 West St., New York.  
Wickes Bros., Saginaw, Mich.

**SHEARING MACHINERY, HAND POWER**

National Machine Tool Co., 1536A Clark St., Racine, Wis.  
Niagara Mch. & Tool Works, Buffalo.  
Peck, Stow & Wilcox Co., Southington, Conn.  
Tucker, W. W. & C. F., Hartford, Conn.

**SHEARS, ROTARY**

Bliss Co., E. W., Brooklyn, N. Y.  
Niagara Mch. & Tool Works, Buffalo.  
Peck, Stow & Wilcox Co., Southington, Conn.  
Ryerson & Son, Joseph T., 2558 W. 16th St., Chicago.  
Toledo Mch. & Tool Co., Toledo, O.  
Union Twist Drill Co., Athol, Mass.

**SHEARS, SQUARING**

Cleveland Punch & Shear Works Co., Cleveland.  
Niagara Mch. & Tool Works, Buffalo.  
Peck, Stow & Wilcox Co., Southington, Conn.  
Toledo Mch. & Tool Co., Toledo, O.

**SHERADIZING, ELECTRIC**

General Electric Co., Schenectady, N. Y.

**SHEAVE WHEELS**

American Manganese Steel Co., 1850 McCormick Bldg., Chicago.  
Jones Foundry & Mch. Co., W. A., 4409 W. Roosevelt Rd., Chicago.  
Link-Belt Co., Chicago, Ill.  
Wood's, T. B. & Sons Co., Chambersburg, Pa.

**SHEET METALS**

American Sheet & Tin Plate Co., Pittsburgh, Pa.

**SHEET METAL WORK**

New Britain Mch. Co., New Britain, Ct.  
Reliance Die & Stamping Co., 515 N. LaSalle St., Chicago.

**SHELVING**

See Furniture, Shop.

**SHIMS, LAMINATED**

Laminated Shim Co., Inc., Long Island City, N. Y.

**SLEEVES**

Cleveland Twist Drill Co., Cleveland.  
Morse Twist Drill & Mch. Co., New Bedford, Mass.  
National Twist Drill & Tool Co., Detroit, Mich.  
Pratt & Whitney Co., Hartford, Conn.  
Standard Tool Co., Cleveland.  
Union Twist Drill Co., Athol, Mass.

**SLIDE RULES**

Keuffel & Esser Co., Hoboken, N. J.

**SLOTTERS, PORTABLE**

Consolidated Machine Tool Corp., Rochester, N. Y.  
Niles-Bement-Pond Co., 111 Broadway, New York.

**SLOTTERS' TRAVELING HEADS**

Nazel Engineering & Mch. Wks., 4043 No. 5th St., Philadelphia, Pa.

**SLOTTING MACHINES, AUTOMATIC SCREW**

Waterbury Farrel Fdry. & Mch. Co., Waterbury, Conn.

**SLOTTING MACHINES**

Baker Bros., Inc., Toledo, O.  
Consolidated Machine Tool Corp., Rochester, N. Y.  
Jones Mch. Tool Wks., Inc., Phila., Pa.  
Manning, Maxwell & Moore, Inc., 100 East 42nd Street, New York.  
Nazel Engineering & Mch. Wks., 4043 N. 5th St., Philadelphia, Pa.  
Niles-Bement-Pond Co., 111 Broadway, New York.  
Rhodes Mfg. Co., Hartford, Conn.  
Sellers & Co., Inc., Wm., Philadelphia.

**SOCKETS**

Cleveland Twist Drill Co., Cleveland.

Greenfield Tap & Die Corp., Greenfield, Mass.

Morse Twist Drill & Machine Co., New Bedford, Mass.

National Twist Drill & Tool Co., Detroit, Mich.

Pratt & Whitney Co., Hartford, Conn.

Standard Tool Co., Cleveland.

Union Twist Drill Co., Athol, Mass.

Williams, J. H. & Co., Buffalo, N. Y.

**SPECIAL MACHINERY AND TOOLS**

Adamson Mch. Co., Akron, O.

Automatic Mch. Co., Bridgeport, Ct.

Baird Machine Co., Bridgeport, Conn.

Barnes, W. F. & John, 231 Ruby St., Rockford, Ill.

Bigram Machine Works, 1231 Spring Garden St., Philadelphia.

Blanchard Machine Co., 64 State St., Cambridge, Mass.

Bliss Co., E. W., Brooklyn, N. Y.

Bradley, C. C. & Son, Inc., Syracuse, N. Y.

Brown Co., A. & F., 79 Barclay St., New York.

Buhr Machine Tool Co., Ann Arbor, Mich.

Cleveland Auto Mch. Co., Cleveland.

Columbia Machine Tool Co., Hamilton, Ohio.

Columbus Die, Tool & Mch. Co., Columbus, O.

Consolidated Machine Tool Corp., Rochester, N. Y.

Earle Gear & Machine Co., 4707 Stenton Ave., Philadelphia.

Farrel-Birmingham Co., Inc., Buffalo.

Ferner, R. Y., Co., Washington, D. C.

Gears & Forgings, Inc., 3122 Woodhill Rd., Cleveland.

Gisholt Machine Co., 1300 E. Washington Ave., Madison, Wis.

Gorton, Geo., Mch. Co., Racine, Wis.

Grant Mfg. & Mch. Co., N. Y. Station, Bridgeport, Conn.

Greenlee Bros. & Co., Rockford, Ill.

Hartford Special Mch. Co., Hartford, Conn.

Hogson & Pettie Mfg. Co., New Haven, Conn.

Ingersoll Milling Mch. Co., Rockford, Ill.

Jones Mch. Tool Wks., Inc., Phila., Pa.

Langellier Mfg. Co., Arlington, Cranton, R. I.

Littell, F. J., Machine Co., 4125 Ravenswood Ave., Chicago.

Lucas Machine Tool Co., Cleveland.

Manufacturers' Consulting Engineers, Syracuse, N. Y.

Medart Co., St. Louis, Mo.

Mehl Mch. Tool & Die Co., Roselle, N. J.

Meisselbach-Catucci Mfg. Co., Newark, N. J.

Meissel Press Mfg. Co., 948 Dorchester Ave., Boston 25, Mass.

Metals Coating Co. of America, Philadelphia, Pa.

National Acme Co., Cleveland, O.

National Automatic Tool Co., Richmond, Ind.

National Mch. Co., Tiffin, Ohio.

National Tool Co., Cleveland.

National Twist Drill & Tool Co., Detroit, Mich.

Niagara Machine Tool Works, Buffalo.

Niles-Bement-Pond Co., 111 Broadway, New York.

Peck, Stow & Wilcox Co., Southington, Conn.

Pratt & Whitney Co., Hartford, Conn.

Precision Engineering Co., Philadelphia.

Reed-Prentice Corp., Worcester, Mass.

Reliance Die & Stamping Co., 515 N. LaSalle St., Chicago.

Rockford Mch. Tool Co., 2400 Kishwaukee Rd., Rockford, Ill.

Ruthman Mch. Co., Cincinnati, O.

S. A. Mch. Wks., 4541 W. Lake St., Chicago, Ill.

Shuster Co., F. B., New Haven, Conn.

Simonds Mfg. Co., Pittsburgh, Pa.

Sweet & Doyle Fdry. & Mch. Co., Troy, Green Island, N. Y.

Taylor-Shantz Co., Rochester, N. Y.

Toledo Mch. & Tool Co., Toledo, O.

Union Twist Drill Co., Athol, Mass.

V & O Press Co., Hudson, N. Y.

Waltham Mch. Works, Waltham, Mass.

Wicaco Screw & Mch. Works, Inc., Philadelphia.

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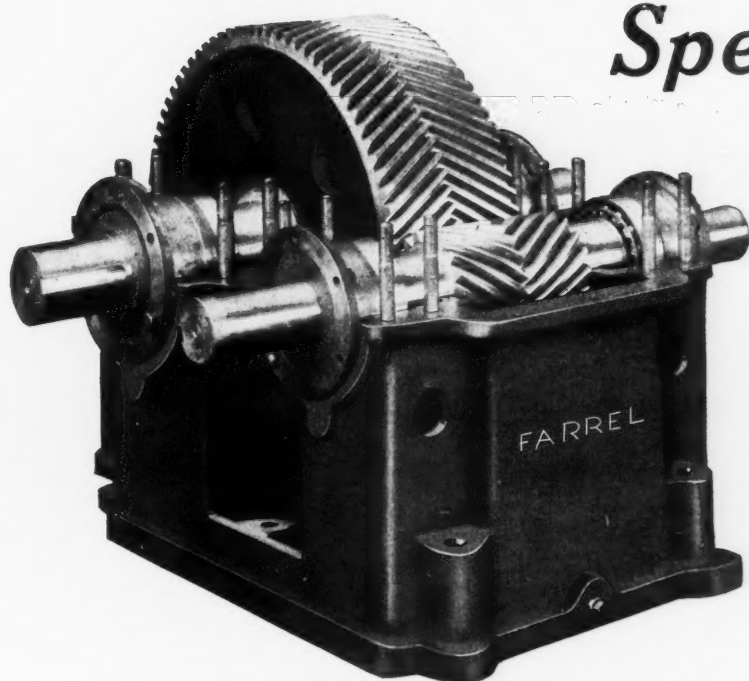
Wicaco Screw & Mch. Works, Inc., Philadelphia.

Wicaco Screw & Mch. Works, Inc., Philadelphia.

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# MODERN

## *Speed Reducers*



Modern because they have  
**FARREL  
SYKES GEARS**  
*(the gear with a backbone)*  
**on Roller Bearings**  
and therefore have a  
**Mechanical Efficiency**  
of about 99%

Engineers recognize that double helical gears are the most efficient means that can be employed for transmitting power and changing speeds between shafts whose axes are parallel. The Farrel-Sykes continuous tooth herringbone gear is universally considered to be the best type of herringbone gear available.

Roller bearings are now manufactured with the accuracy essential for continued operation under heavy loads. We have, therefore, designed a complete series of speed reducers which combine the best type of gear and the best type of roller bearing. The construction of these speed reducers is of the sturdy design necessary for continued operation and freedom from breakdowns and maintenance expenses.

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Murchey Mch. & Tool Co., 34 Porter St., Detroit, Mich.  
National Mch. Co., Tiffin, Ohio.  
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Simonds Saw & Steel Co., Fitchburg, Mass.  
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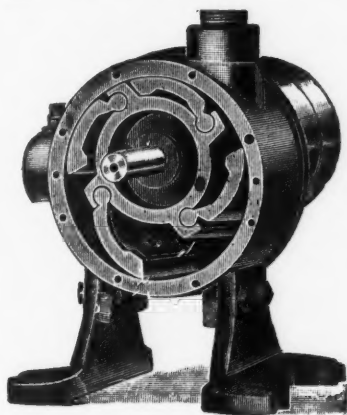
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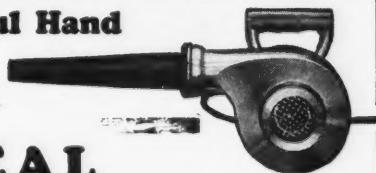
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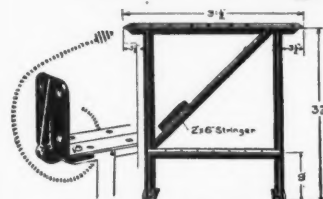
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This material, ranging in size from 3/16" to 1/2" diameter, is supplied in 80-foot coils, which the Shuster ma-

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*with straight blades*

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*for accuracy*



*for economy*

## I

Ideal Commutator Dresser Co.	305
Imperial Brass Mfg. Co.	254
Independent Pneu. Tool Co.	124
Industrial Press	136
Ingersoll Milling Machine Co.	20
Ingersoll-Rand Co.	168
International Machine Tool Co.	98

J. & H. Electric Co.	266
Jacobs Mfg. Co.	36
Jarvis, Benj. E., Inc.	240
Jarvis, Chas. L., Co.	268
Johnson, Carlyle Machine Co.	76
Johnston & Jennings Co., Inc.	276
Jones & Lamson Mch. Co.	16-17
Jones, W. A., Fdry. & Mch. Co.	205
Jones Machine Tool Works, Inc.	54

Kasnit Co. ....	254
Kearney & Trecker Corp. ....	19
Keller Mechanical Engineering Corp. ....	270
Kelly, R. A., Company. ....	256
Kempsmith Mfg. Co. ....	32
Keuffel & Esser Co. ....	279
Kingsbury Machine Tool Corp. ....	148
Knight, W. B., Machinery Co. ....	230

Laminated Shim Co., Inc.	190
Landis Machine Co., Inc.	12-13
Landis Tool Co.	130-131
Langelier Mfg. Co.	184
Lapointe, J. N., Co.	185
Lapointe Mch. Tool Co.	164
LaSalle Mch. Wks., Inc.	172
LaSalle Tool Co.	295
LeBlond, R. K., Mch. Tool Co.	10
Leeds & Northrup Co.	255
Lees-Bradner Co.	74-75
Leiman Bros.	305
Leitz, E., Inc.	258
Leland-Gifford Co.	3
Liberty Machine Tool Co.	154
Lincoln Electric Co.	237
Lindsay-McMillan Co.	231
Link-Belt Company	212
Littell, F. J., Machine Co.	280
Lodge & Shipley Mch. Tool Co.	8-9
Logansport Machine Co.	267
Loshbough-Jordan Tool & Mch. Co.	173
Lovejoy Tool Co., Inc.	260
Lowe, H. A.	256
Lucas Machine Tool Co.	91
Luma Electric Equipment Co.	192

Machine Products Co.....	206
Machinery .....	136
Madison-Kipp Corp. ....	69
Madison Mfg. Co.....	260
Manning, Maxwell & Moore, Inc. ....	2
Manufacturers' Consulting Engineers .....	278
Marquette Tool & Mfg. Co...170	
Massachusetts Gear & Tool Co.204	
McCrosky Tool Corp.....	308
McGill Metal Co.....	276
Medart Company .....	218
Mehl Mch. Tool & Die Co.....278	
Meisel Press Mfg. Co.....	200
Meisselbach-Catucci Mfg. Co.198	
Merrell Manufacturing Co.....184	
Metalwood Mfg. Co.....	178
Michigan Tool Co.....	65
Miles Machinery Co.....	282
Millers Falls Co.....	112
Millholland Sales & Engineering Co. ....	151
Minster Machine Co.....	179
Mitts & Merrill.....	107

## Н

Danly Machine Specialties, Inc.	176
Dart, E. M., Mfg. Co.	206
Davis Keyseater Co.	142
Davis, Rodney	206
Davis Boring Tool Co., Inc.	263
Defiance Machine Works	153
Desmond-Stephan Mfg. Co.	164
Detroit Stamping Co.	230
Diamond Machine Co.	244
Diamond Saw & Stamping Wks.	240
Diefendorf Gear Corp.	204
Dreses Machine Tool Co.	155
Dyson, Joseph, & Sons	276

Earle Gear & Machine Co.	202
Eastern Machine Screw Corp.	261
Eastern Machinery Co.	282
Eastern Tube & Tool Co., Inc.	287
Edgemont Mch. Co.	222
Elgin Tool Works, Inc.	144
Elmes, Chas. F., Engineering Works	295
Errington Mech. Laboratory	267
Espen-Lucas Machine Works	241
Essley, E. L. Machinery Co.	281
Etna Machine Co.	183
Ex-Cell-O Tool & Mfg. Co.	110

Hall Planetary Co.	133
Hanna Engineering Works.	224
Hannifin Mfg. Co.	61
Hanson-Whitney Machine Co.	68
Hardinge Bros., Inc.	14
Harrington Company	224
Hartford Special Mchy. Co.	196
Haskins, R. G., Company	269
Hawkrigde Bros. Co.	190
Haynes Stellite Co.	81
Heald Machine Co.	63
Hendey Machine Co.	57
Herbert, Alfred, Ltd.	306
High Speed Hammer Co., Inc.	183
Hill-Curtis Co.	164
Hilliard Corp.	222
Hindley Gear Co.	200-282
Hjorth Lathe & Tool Co.	280
Hoefler Mfg. Co.	155
Hoggson & Pettis Mfg. Co.	266
Hoover Steel Ball Co.	216
Horsburgh & Scott Co.	197
Hoskins Mfg. Co. Inside Back Cover	
Hunter Saw & Machine Co.	241
Hurlbut, Rogers Mchy. Co.	180
Huther Bros. Saw Mfg. Co., Inc.	240
Hyatt Roller Bearing Co.	219
Hyman, Joseph & Sons.	282

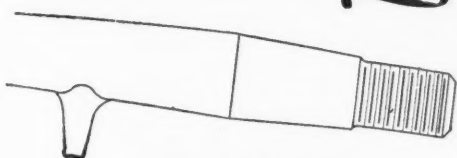


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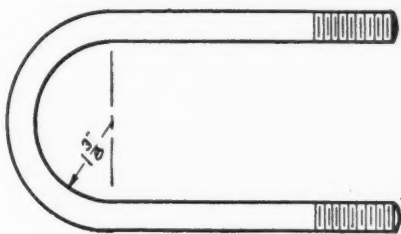
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# A Dreadnought for Sandino

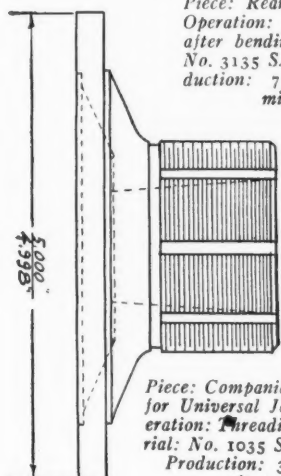
— or a handful of Marines?



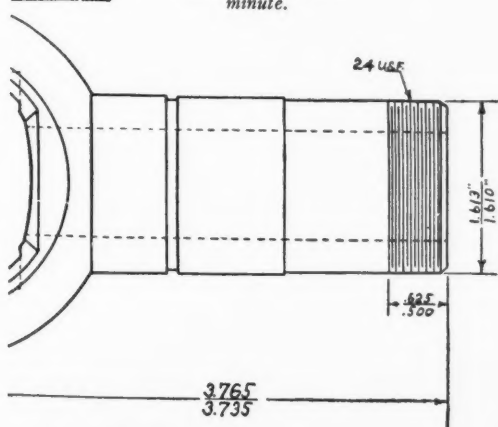
Piece: Drop Forged Steering Knuckle. Operation: Threading. Production:  $7\frac{1}{4}$  pieces per minute.



Piece: Rear Spring Clip. Operation: Threading after bending. Material: No. 3135 SAE Steel. Production:  $7\frac{1}{2}$  Ends per minute.



Piece: Companion Flange for Universal Joints. Operation: Threading. Material: No. 1035 SAE Steel. Production:  $3\frac{1}{2}$  per minute.



Piece: Sleeve Yoke for Universal Joint. Operation: Threading. Material: No. 1035 SAE Steel. Production:  $7\frac{1}{2}$  pieces per minute.

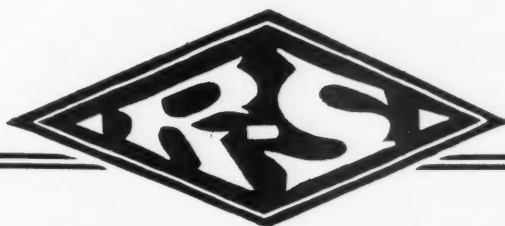
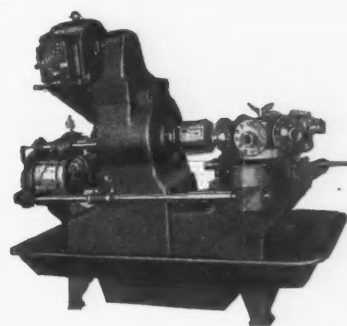
Uncle Sam hasn't sent the Navy on Sandino's trail. Too expensive!—and it's not the Navy's job. A few hundred Marines can clear up the situation in less time and at less cost than all the battleships in the world.

By the same token—why thread on automatics? It's not *their* job, and by keeping them off their regular work, it greatly limits their earning capacities. R-S Automatic Threading (Second Operation) machines will return their cost in no time in money saved—and your production will go sky-high.

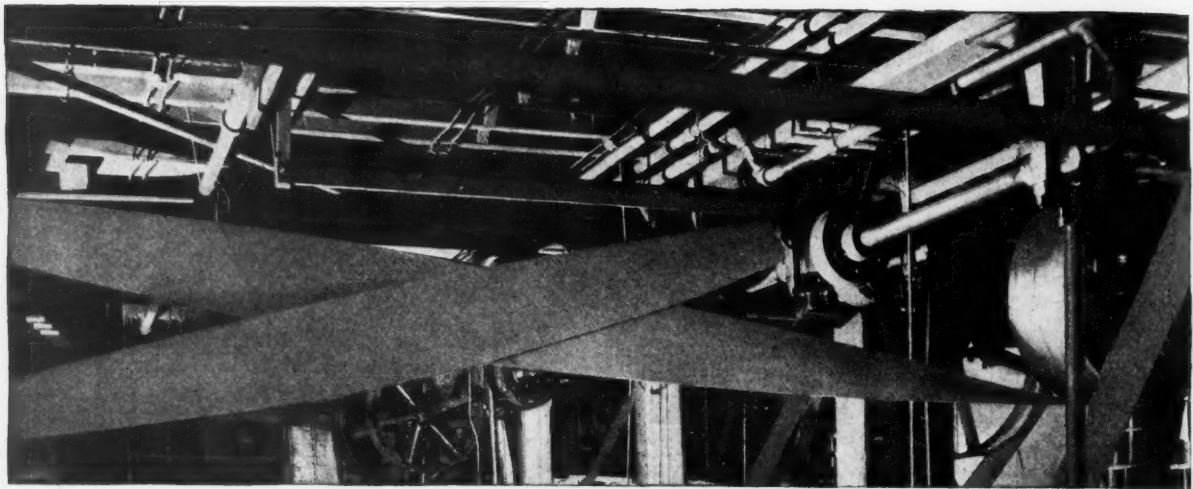
You can put them on all kinds of jobs—threading, drilling, tapping, facing, reaming, chamfering. Look over some of the jobs shown here—then ask yourself if you can afford not to duplicate such results.

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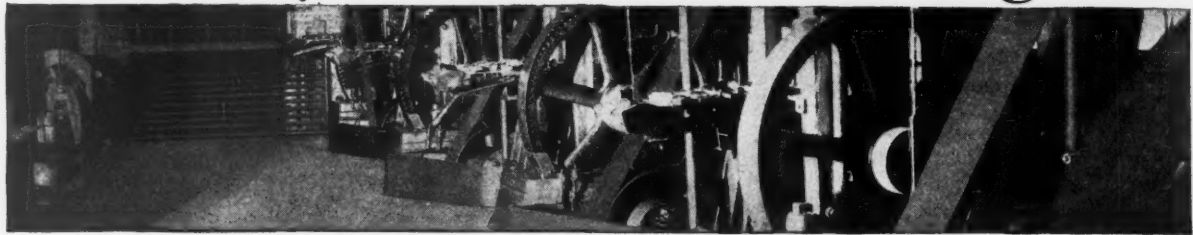
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## It Doesn't Pay to Thread on Automatics



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This company has many other Graton & Knight belts throughout the plant. The crossed motor drive you see in this photo is one of them. Some of them that are running in this plant today were put on as much as 28 years ago.

May we send you our Standardized Belting

Manual that explains why Graton & Knight belts last longer, why they work better, why they deliver the most for your money? It makes good, convincing reading if you're interested in reducing operating costs.

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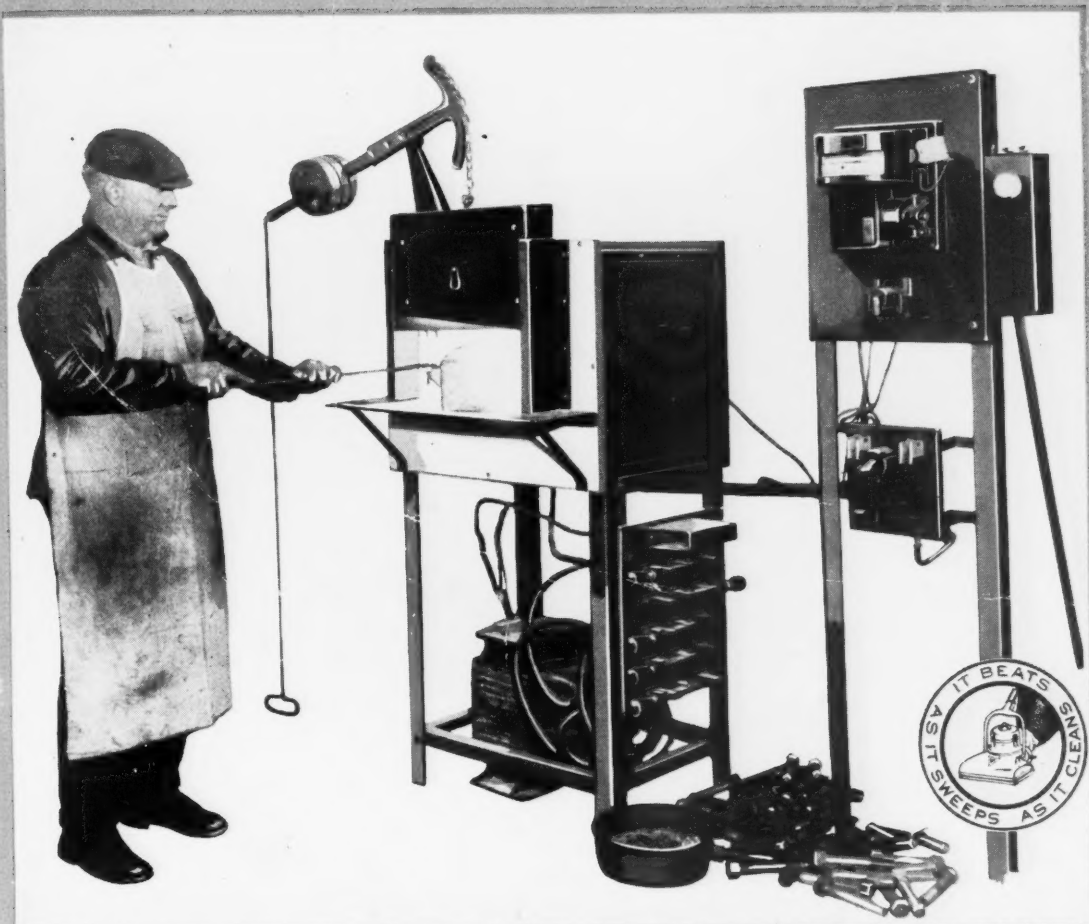
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extra work. If you want clean dies and good tools, you can get them, as The Hoover Company does, in a Hoskins Electric Furnace. No tool can be any better than its heat-treatment; then why put up with any other form of heat, when you can get maximum results from electric heat? In the furnace shown here, the Chromel heating-units are of the hairpin type, located on all sides of the heating space. They are durable and easy to renew.

For details, send for Catalog-51M.

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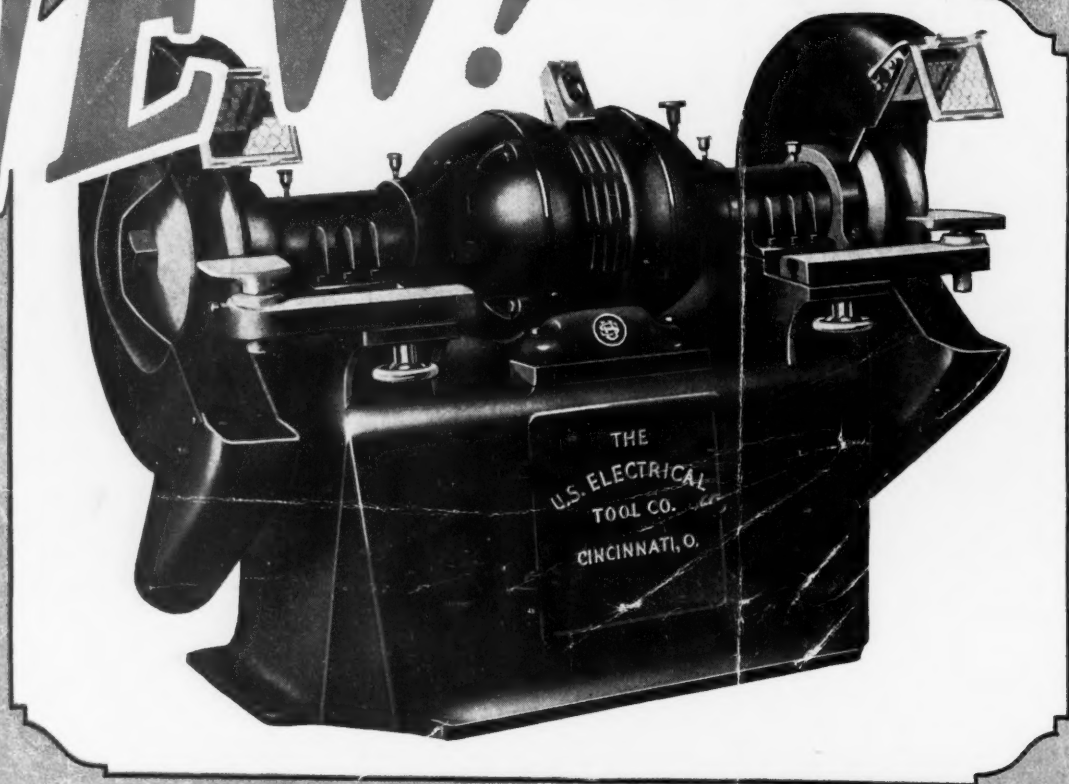
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Originators and Manufacturers of **Chromel** The Alloy that made Electric Heat Possible

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